# REQUEST FOR QUOTATION - ONLINE BIDDING

MMI:PU:RF:003

BHARAT HEAVY ELECTRICALS LIMITED
Electronics Division
PB No. 2606, Mysore Road Bangalore - 560026
INDIA

RFQ NUMBER:
NKRE000747

| Sl No. | Description | Qty | Unit | Delivery qty |
|---|---|---|---|---|
| 1 | TI0668123027 Line Voltage Trafo-25KV/100V-MEMU-Round<br>* HSN/SAC : 8504<br>Test Certificate<br>1. Line voltage transformer- 1no 2. Other Accessories required for<br>mounting and Electrical connections As per TBSG Specification.No<br>:TBSG/ACMEMU/02/LVT<br><br>2.Reference Drwaing No of TYPE LOCO3/AE<br>:N°2-43842-13 ( Round Base<br>,with bottom secondary terminal arrangement )<br><br>3. Mounting hard wares and Hard ware Nut for Connecting Primary terminal<br>and earth connection | 66 | ST | 66 |

Total Number of Items - 1

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1.
2.

## Clause on IP in the tender

**Integrity Pact (IP)**

(a) IP is a tool to ensure that activities and transactions between the Company and its Bidders/ Contractors are handled in a fair, transparent and corruption free manner. Following Independent External Monitors (IEMs) on the present panel have been appointed by BHEL with the approval of CVC to oversee implementation of IP in BHEL.

| Sl | IEM | Email |
|---|---|---|
| 1. | Shri Otem Dai, IAS (Retd.) | iem1@bhel.in |
| 2. | Shri Bishwamitra Pandey, IRAS (Retd.) | iem2@bhel.in |
| 3. | Shri Mukesh Mittal, IRS (Retd.) | iem3@bhel.in |

(b) The IP as enclosed with the tender is to be submitted (duly signed by authorized signatory) along with techno-commercial bid (Part-I, in case of two/ three part bid). Only those bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this Pact would be a preliminary qualification.

(c) Please refer Section-8 of IP for Role and Responsibilities of IEMs. In case of any complaint arising out of the tendering process, the matter may be referred to any of the above IEM(s). All correspondence with the IEMs shall be done through email only.

*Note:*

*No routine correspondence shall be addressed to the IEM (phone/ post/ email) regarding the clarifications, time extensions or any other administrative queries, etc on the tender issued. All such clarification/ issues shall be addressed directly to the tender issuing (procurement) department's officials whose contact details are provided below:*

Details of contact person(s):

(1)
Name:__Nilmani Kumar__
Deptt: ___CE-MM_____
Address: _BHEL-EDN, Post Box – 2606, Bangalore - 26
Phone: (Landline/ Mobile) __
080-26999063_____
Email: nilmanikumar@bhel.in
Fax: _____

(2)
Name:__JP Masand_____
Deptt: __CE-MM_____
Address: BHEL-EDN, Post Box – 2606, Bangalore - 26
Phone: (Landline/ Mobile) __
080-26998791_____
Email: jpmasand@bhel.in
Fax: _____

Annexure-1

**INTEGRITY PACT**

**Between**

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Siri Fort, New Delhi - 110049 (India) hereinafter referred to as "The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

**and**

_____, (description of the party along with address), hereinafter referred to as "The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

**Preamble**

The Principal intends to award, under laid-down organizational procedures, contract/s for _____

Line Voltage Trafo-25KV/100V-MEMU-Round (NKRE000747)

_____ (hereinafter referred to as "Contract"). The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint panel of Independent External Monitor(s) (IEMs), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

**Section 1- Commitments of the Principal**

1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles: -

1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

1.1.3 The Principal will exclude from the process all known prejudiced persons.

1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

**Section 2 - Commitments of the Bidder(s)/ Contractor(s)**

2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. The Bidder(s)/ Contractor(s) commits himself to observe the following principles during participation in the tender process and during the contract execution.

2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he/ she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant Indian Penal Code (IPC) and Prevention of Corruption Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

2.1.4 Foreign Bidder(s)/ Contractor(s) shall disclose the name and address of agents and representatives in India and Indian Bidder(s)/ Contractor(s) to disclose their foreign principals or associates. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

2.3 The Bidder(s)/ Contractor(s) shall not approach the Courts while representing the matters to IEMs and shall await their decision in the matter.

**Section 3 - Disqualification from tender process and exclusion from future contracts**

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/ Contractor(s) from the tender process , terminate the contract, if already awarded, exclude from future business dealings and/ or take action as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

**Section 4 - Compensation for Damages**

4.1 If the Principal has disqualified the Bidder (s) from the tender process before award / order acceptance according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.

4.2 If the Principal is entitled to terminate the Contract according to Section 3, or terminates the Contract in application of Section 3 above , the Bidder(s)/ Cotractor (s) transgression through a violation of Section 2 above shall be construed breach of contract and the Principal shall be entitled to demand and recover from the Contractor an amount equal to 5% of the contract value or the amount equivalent to Security Deposit/ Performance Bank Guarantee , whichever is higher, as damages, in addition to and without prejudice to its right to demand and recover compensation for any other loss or damages specified elsewhere in the contract.

**Section 5 - Previous Transgression**

5.1 The Bidder declares that no previous transgressions occurred in the last 3 (three) years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.

5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason or action can be taken as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

**Section 6 - Equal treatment of all Bidder (s)/ Contractor (s) / Sub-contractor (s)**

6.1 The Principal will enter into Integrity Pacts with identical conditions as this Integrity Pact with all Bidders and Contractors.

6.2 In case of Sub-contracting, the Principal Contractor shall take the responsibility of the adoption of Integrity Pact by the Sub-contractor(s) and ensure that all Sub-contractors also sign the Integrity Pact.

6.3 The Principal will disqualify from the tender process all Bidders who do not sign this Integrity Pact or violate its provisions.

**Section 7 - Criminal Charges against violating Bidders/ Contractors /Subcontractors**

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

**Section 8 -Independent External Monitor(s)**

8.1 The Principal appoints competent and credible panel of Independent External Monitor (s) (IEMs) for this Integrity Pact. The task of the IEMs is to review independently and objectively, whether and to what extent the parties comply with the obligations under this Integrity Pact.

8.2 The IEMs are not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.

8.3 The IEMs shall be provided access to all documents/ records pertaining to the Contract, for which a complaint or issue is raised before them as and when warranted. However, the documents/records/information having National Security implications and those documents which have been classified as Secret/Top Secret are not to be disclosed.

8.4 The Principal will provide to the IEMs sufficient information about all meetings among the parties related to the Contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the IEMs the option to participate in such meetings.

8.5 The advisory role of IEMs is envisaged as that of a friend, philosopher and guide. The advice of IEMs would not be legally binding and it is restricted to resolving issues raised by a Bidder regarding any aspect of the tender which allegedly restricts competition or bias towards some Bidders. At the same time, it must be understood that IEMs are not consultants to the Management. Their role is independent in nature and the advice once tendered would not be subject to review at the request of the organization.

8.6 For ensuring the desired transparency and objectivity in dealing with the complaints arising out of any tendering process or during execution of Contract, the matter should be examined by the full panel of IEMs jointly, who would look into the records, conduct an investigation, and submit their joint recommendations to the Management.

8.7 The IEMs would examine all complaints received by them and give their recommendations/ views to the CMD, BHEL at the earliest. They may also send their report directly to the CVO, in case of suspicion of serious irregularities requiring legal/ administrative action. Only in case of very serious issue having a specific, verifiable Vigilance angle, the matter should be reported directly to the Commission. IEMs will tender their advice on the complaints within 30 days.

8.8 The CMD, BHEL shall decide the compensation to be paid to the IEMs and its terms and conditions.

8.9 IEMs should examine the process integrity, they are not expected to concern themselves with fixing of responsibility of officers. Complaints alleging mala fide on the part of any officer of the Prinicpal should be looked into by the CVO of the Principal.

8.10 If the IEMs have reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant Indian Penal Code / Prevention of Corruption Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the IEMs may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.11 After award of work, the IEMs shall look into any issue relating to execution of Contract, if specifically raised before them. As an illustrative example, if a Contractor who has been awarded the Contract, during the execution of Contract, raises issue of delayed payment etc. before the IEMs, the same shall be examined by the panel of IEMs. Issues like warranty/ guarantee etc. shall be outside the purview of IEMs.

8.12 However, the IEMs may suggest systemic improvements to the management of the Principal, if considered necessary, to bring about transparency, equity and fairness in the system of procurement.

8.13 The word `Monitor' would include both singular and plural.

**Section 9 - Pact Duration**

9.1 This Integrity Pact shall be operative from the date this Integrity Pact is signed by both the parties till the final completion of contract for successful Bidder, and for all other Bidders 6 months after the Contract has been awarded. Any violation of the same would entail disqualification of the bidders and exclusion from future business dealings.

9.2 If any claim is made/ lodged during currency of this Integrity Pact, the same shall be binding and continue to be valid despite the lapse of this Pact as specified above, unless it is discharged/ determined by the CMD, BHEL.

**Section 10 - Other Provisions**

10.1 This Integrity Pact is subject to Indian Laws and exclusive jurisdiction shall be of the competent Courts as indicated in the Tender or Contract, as the case may be.

10.2 Changes and supplements as well as termination notices need to be made in writing.

10.3 If the Bidder(s)/ Contractor(s ) is a partnership or a consortium or a joint venture, this Integrity Pact shall be signed by all partners of the partnership or joint venture or all consortium members.

10.4 Should one or several provisions of this Integrity Pact turn out to be invalid, the remainder of this Integrity Pact remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

10.5 Only those bidders / contractors who have entered into this Integrity Pact with the Principal would be competent to participate in the bidding. In other words, entering into this Integrity Pact would be a preliminary qualification.

10.6 In the event of any dispute between the Principal and Bidder(s)/ Contractor(s) relating to the Contract, in case, both the parties are agreeable, they may try to settle dispute through Mediation before the panel of IEMs in a time bound manner. In case, the dispute remains unresolved even after mediation by the panel of IEMs, either party may take further action as the terms & conditions of the Contract. The fees/expenses on dispute resolution through mediation shall be shared by both the parties. Further, the mediation proceedings shall be confidential in nature and the parties shall keep confidential all matters relating to the mediation proceedings including any settlement agreement arrived at between the parties as outcome of mediation. Any views expressed, suggestions, admissions or proposals etc. made by either party in the course of mediation shall not be relied upon or introduced as evidence in any further arbitral or judicial proceedings, whether or not such proceedings relate to the dispute that is the subject of mediation proceedings. Neither of the parties shall present IEMs as witness in any Alternative Dispute Resolution or judicial proceedings in respect of the dispute that was subject of mediation.

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For & On behalf of the Principal
(Office Seal)

ಉಪ ವ್ಯವಸ್ಥಾಪಕರು/ನಿ.ಉ.-ಎಂ.ಎಂ.
नीलमणि कुमार, उप प्रबंधक/सी.ई.-एम.एम.
Place NILMANI KUMAR, DY. MANAGER/CE-MM
Date BHEL-EDN, MYSURU ROAD, BENGALURU-560026

Witness:
(Name & Address)
ಆದಿಲ್ ಮೊಬೀನ್, ಪ್ರಬಂಧಕರು/ನಿ.ಉ.-ಎಂ.ಎಂ., ದೇಶೀಯ ಮತ್ತು ವಿದೇಶೀಯ ಖರೀದಿ
~~आदिल मोबीन, प्रबंधक/सी.ई.-एम.एम., स्वदेशी एवं विदेशी खरीद~~
AADIL MOBIN, MANAGER/CE-MM, INDIGENOUS & IMPORTS PURCHASE
BHEL-EDN, MYSURU ROAD, BENGALURU-560026

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For & On behalf of the Bidder/ Contractor
(Office Seal)

Witness:
(Name & Address)

## 1.0 Pre-Qualification Criteria

1.1 The bidder should be a manufacturer/supplier of the **Line Voltage Transformer** for Rolling stock application of Railways for 3 phase IGBT based Train sets/RRTS/Semi high speed trains/AC EMU/MEMU/Metros in India or any railway systems in the world.

1.2 For supplies made in India, bidder should be approved vendor of Indian Railways /Metro/RRTS.

**OR**

For supplies made to any railway systems in the world, bidder shall provide approval, authenticated by country's recognized railway organization. Acceptance of such approvals will be at BHEL's discretion.

1.3 The product should have valid type test certificates complying to relevant latest IEC and other standards mentioned in the Reference Technical Specification **(TBSG/ACMEMU/02/LVT)** for rolling stock application on the date of submission of the tender. The bidder shall fully comply with the type and routine test & inspection clause of the technical specification. The bidder shall conduct/repeat type tests either partially or fully **for the offered product** without any price implication to BHEL. Decision to conduct type test shall be at BHEL's discretion.

**OR**

The bidder shall provide valid type test certificate/reports complying to relevant latest IEC and other standards for similar product supplied as per clause 1.1. Acceptance of such type test certificate/reports will be at BHEL's discretion. In such case, bidder will be considered for technical evaluation. The bidder shall conduct type tests fully **for the offered product**, without any price implication to BHEL.

1.4 Those bidder(s) who are registered with BHEL/ BHEL's customer (as the case may be) shall be considered for technical evaluation, subject to meeting above PQC clauses.
Bidders who are not registered with BHEL/BHEL's customer (as the case may be) can also quote in the tender. However, their credentials will be assessed for consideration in the tender, before price bid opening, subject to meeting above PQC clauses.

## 2.0 Documents to be submitted

All the relevant documents proof for points referred in 1.0 shall be submitted along with the tender.

**BHARAT HEAVY ELECTRICALS LIMITED**
**TRANSPORTATION BUSINESS & SYSTEMS GROUP,**
**INDUSTRY SECTOR, LODHI ROAD, NEW DELHI**

| DOCUMENT No | **TBSG/ACMEMU/02/ LVT** | Rev. No. | **00** | | Prepared | Checked | Approved |
|---|---|---|---|---|---|---|---|
| TYPE OF DOC. | **TECHNICAL SPECIFICATION** | | | NAME | **S K Jain** | **Prafful Lakra** | **A. K Yadav** |
| **TITLE** **LINE VOLTAGE TRANSFORMER** | | | | SIGN | | | |
| | | | | DATE | 08.03.2018 | | |
| | | | | GROUP | TBSG | | |
| **CUSTOMER/ CONSULTANT** | **BHEL/INDIAN RAILWAYS** | | | | | | |
| **PROJECT** | **DESIGN, DEVELOPMENT, MANUFACTURE, SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 25kV IGBT BASED THREE PHASE ELECTRICS (ON BOARD MOUNTED) FOR AC MEMU** | | | | | | |



# TECHNICAL SPECIFICATION

## LINE VOLTAGE TRANSFORMER

| Rev No. | Date | Altered | Checked | Approved | REVISION DETAILS |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| Distribution | To | *Office Copy* | *TSG-MM* | | | | |
|---|---|---|---|---|---|---|---|
| | Copies | | | | | | |

Table of Contents:

# SECTION – 1

# SCOPE, QUANTITIES & ELIGIBILITY

## 1.1 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of LINE VOLTAGE TRANSFORMER.
The equipment is required for the following project.

**Name of the customer** : BHEL/INDIAN RAILWAYS
**Name of the Project** : DESIGN, DEVELOPMENT, MANUFACTURE, SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 25kV IGBT BASED THREE PHASE ELECTRICS (ON BOARD MOUNTED) FOR AC MEMU.

The scope shall also include the followings:

a. The supply of complete documentation for approval of design, relevant drawings and calculations to the satisfaction of purchaser and RDSO and support documentation associated with the operation and maintenance of the equipment supplied.
b. The supplier shall submit list of equipment and facilities required for maintenance and overhaul of equipment offered.

## 1.2 BILL OF MATERIAL:

| Sl. No. | Description | Qty per Set (4 Coach Unit) | Remarks |
|---|---|---|---|
| 1. | **LINE VOLTAGE TRANSFORMER** | **1 No.** | |
| 2. | **OTHER ACCESSORIES REQUIRED FOR MOUNTING AND ELECTRICAL CONNECTIONS** | **As required** | |

## 1.3 ELIGIBILITY CRITERIA

The Bidder should be a regular supplier to Indian Railway Projects and should have supplied the offered equipment for Indian Railways projects of 3 phase IGBT Based AC EMU/MEMU or 3 Phase IGBT based Locomotives or Metros operating in India.

## 1.4 CLAUSE BY CLUASE COMPLIANCE

Vendor to submit clause by clause compliance to complete technical specification along with the technical bid.

# SECTION – 2

# STANDARD TECHNICAL SPECIFICATION

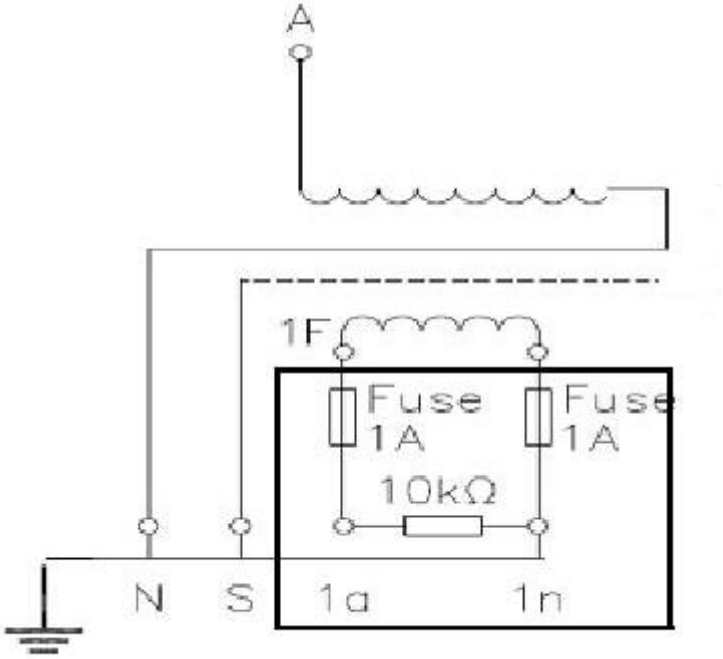
## 2.1 Technical specifications

Technical specifications for Line Voltage transformer should conform to the design data as given below:

| Description | Parameter |
|---|---|
| No. of Primary Winding | 1 |
| Primary Winding Voltage | 25000V |
| No. of Secondary Winding | 1 |
| Secondary Winding Voltage | 100V |
| Burden of each secondary winding | 10 VA |
| Accuracy class of each secondary winding | ± 0.5 |
| Voltage factor | 1.5*Ur/30 sec. |
| Thermal current | 1.0-1.0 A |
| Primary resistance [R1] | ≈ 50.9 kΩ |
| Frequency | 50 Hz |
| Insulation | Cast resin insulated |
| Color of composite insulator | Brown |
| Insulation level | 36/75/170 kV |
| Ambient Temperature | -25°C…+50°C |
| Insulation class | E |
| Partial discharge intensity | ≤ 20 pC @ 33 kV<br>≤ 50 pC @ 47.6 kV |
| Creepage distance | 1090 mm |
| Standard | IEC 60044-2 & 50152-3-3 |
| Weight | <54 Kg |
| Limit of Percentage Voltage (ratio) error | As per IEC : 60044-2<br>(Value to be specified) |
| Phase Displacement | As per IEC : 60044-2 (Value to be specified) |

**1.** The vendor is required to provide a screen between the high voltage coil and the secondary winding to protect the secondary circuit against transient over voltages. The screen should be grounded direct to the Ring at the bottom of the PT. The fuses along with the resistance shall be as shown in the electrical diagram in Clause 2.4 of this spec. **Only the LVT is in the scope of supply of the supplier. LVT panel, fuses and resistances are not in the scope of supply of vendor.**

2. **ELECTRICAL DIAGRAM OF LVT TO BE FOLLOWED:**




**The fuses and the resistances shall be placed in a panel which shall not be in the scope of supply of the vendor.**

**3. MAINTENANCE INSTRUCTION/ GUIDELINES:**

The vendor must submit detailed maintenance instructions/ guidelines along with their periodicity.

**4. MOUNTING AND INSTALLATION REQUIREMENTS**

The vendor to furnish mounting drawing for the purpose of installation and mounting at the coach builders shop. The drawing should be self-explanatory and complete in all respects.

**2.2 In addition to the above mentioned technical requirements, the offered equipment must comply to relevant IECs/other applicable standards.**

**2.3 EQUIPMENT TESTING:**

(1) **Valid Type test report** is to be submitted for the equipment along with offer, if the equipment is already type tested. In case, ultimate customer insists to repeat the type tests due to any reason, the type test shall be conducted again by the supplier, for which test procedure shall also be submitted by the supplier for approval before conducting the type test. In case ultimate customer desires to witness the type tests, the supplier shall have no objection. The supplier is required to quote for the type test charges if any,

separately in commercial offer. These charges will be loaded in the equipment price at the time of final evaluation.

(2) Supplier to submit Routine test certificates and inspection certificate of equipment as per QAP along with equipment.

(3) Type and routine test will also confirm to clause 3.11 of section 3 of technical specification.

**2.4 DESIGN REQUIREMENTS TO BE PROVIDED BY SUPPLIER:**

| | |
|---|---|
| • Write-up/ description of each equipment | To be provided by supplier |
| • Circuit diagram, connection & wiring diagram, equipment drawing with mounting details, weights, center of gravity, etc. and any other relevant drawings. | To be provided by supplier |
| • Datasheets of the Equipment | To be provided by supplier |
| • Type test protocol & procedure/ Type test reports | Supplier to submit the complete reports of type test already conducted on the proposed/offered equipment.<br>In case type test is required to be done, supplier to submit the detailed test procedures for approval.<br><br>Supplier to submit Routine test certificates and inspection certificate of equipment as per QAP along with equipment. |
| • Complete Bill of Material for proven design | To be provided by supplier |
| • Performance statement | To be provided by supplier in the attached format. |
| • Performance certificate | To be provided by supplier in the attached format. |
| • RDSO Approval letter (conforming to the latest RDSO spec as applicable) | To be provided by supplier |
| • Project specific AUTO CAD drawing-2D and 3D model | To be provided by supplier after order placement |
| • Project Specific Drawings in A3 size | To be provided by supplier |
| • Technical Manual | To be provided by supplier |
| • Installation, Operational and Maintenance Manual | To be provided by supplier |

# SECTION – 3

# PROJECT DETAILS AND GENERAL SPECIFICATIONS

## 3 GENERAL

This section stipulates the General Technical Requirements under the contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other sections and are not exclusive.

However, in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

### 3.1 INSTRUCTION TO BIDDERS

The bidders shall submit the technical requirements, data and information as per the technical specification, provided in Section-2.

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc. fully in conformity with the technical specification. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously.

### 3.2 GENERAL DESIGN REQUIREMENTS

i) The traction equipment shall be suitable for operation with 25 KV AC, 50 Hz supplied by overhead contact wires. In case of MEMUs, the control equipment shall be suitable to permit multiple operation up to 24 coach formation of 06 basic units here each basic unit shall comprise of 01 (one) motor coach and 03 associated trailer coaches.

ii) The equipment design shall incorporate all essential features necessary to yield high traffic use, low maintenance requirements, easy maintainability, high reliability in operation and high efficiency with low Specific Energy Consumption (SEC).

iii) The stock fitted with the supplied equipment shall meet the operating/service conditions and performance requirements as specified in section 3.3 Ambient conditions/operating conditions of this specification respectively and shall be suitable for varying loading conditions.

iv) The entire equipment shall be designed to ensure satisfactory and safe operation under the running conditions specified in section 3.3 Ambient conditions/operating conditions and especially under sudden variations of load and electric pressure as may arise under working conditions due to faulty operation and short circuits. The design shall also facilitate erection, inspection, maintenance and replacement of the various units comprising the equipment.

v) All working parts of the control and auxiliary circuit specifically electronics and PCBs, shall be suitably covered in cubicles with essential interlocks/keys to keep them free from moisture and dust. As a minimum, equipment shall be sealed to the standard below:

   a. Under frame mounted equipment (except traction motor) IP65.
   b. Equipment mounted inside the car body IP54.

   The protection level (IP level) shall be furnished by the supplier during design approval.

vi) All the electrical equipment's shall comply with the latest edition of IEC specifications unless otherwise specified. The temperature rise shall be measured according to the procedure stipulated by IEC and shall comply with the limits specified and the ambient conditions defined in this specification. Specified temperature rise of equipment shall be calculated after taking into account at least 25 % choking of air filters and radiator fins etc.

vii) All equipment's shall be adequately earthed, insulated, screened or enclosed. They shall be provided with essential interlocks and keys as may be adequate to ensure the protection of the equipment and the safety of those concerned with its operation and maintenance.

viii) If applicable, supplier shall study the currently available lubricants/cooling oils in India and employ these as far as possible. Full lubrication scheme and schedule for the equipment shall be submitted. Wherever the imported lubricants or cooling oil are used, Supplier shall study and furnish details of equivalent Indian lubricants/oil.

ix) The equipment shall be designed keeping in view that the EMUs/MEMUs operates with doors and windows wide open.

x) The design shall also facilitate easy erection by means of suitable tools & equipment, inspection, maintenance and replacement of the various units comprising the equipment.

xi) Supplier shall submit 3D models of propulsion & other equipment, cooling system, driver/shunting desk, cab layout and roof/under frame/HT compartment layouts populated with equipment etc.

xii) The design of the equipment shall be based on sound, proven and reliable engineering practices. The equipment used in different sub systems shall be of proven technology and design. The supplier shall submit the supportive document for each of the

assembly/sub-assembly for its proven performance under the environmental conditions prevalent in India.

xiii) The supplier shall design the mounting arrangements suitable for coaches to be manufactured by IR. The accessories for mounting the equipment shall be in the scope of supply. The hardware for mounting, safety links for underslung equipment, the termination hardware also will be in the scope of supply all equipment.

xiv) **SOFTWARE (IF APPLICABLE)**

a. Software shall be written in a structured manner and fully documented during all stages of its design and development. This shall meet the requirements of EN 50126-2: Dependability for Guided Transport Systems - Part 2: Safety, EN 50128: Railway Applications: Software for Railway Control and Protection Systems, and EN 50129: Safety related Electronic Railway Control and Protection Systems. Any deviation from this requirement will need approval of RDSO in design stage.

b. Logic of the Software of various sub-systems shall be approved by RDSO in consultation with user railways at the design approval stage. The supplier shall submit the values of parameters, list of fault messages, their environmental data sets, hierarchy of fault display, fault categorization, trouble shooting of each fault, etc. for approval of RDSO. Changes in parameters shall be demonstrated with their effect on results.

c. The supplier shall submit software logic diagrams with detail explanation along with complete software packages to be loaded in train management system before the commissioning of the prototype rake. Parametric changes shall be possible in the software in order to meet future requirements, such as change in acceleration and deceleration, bogie and coach suspension, train configurations, OHE voltage and frequency, etc. While listing out the values of various parameters, the contractor must provide a range within which any change can be made without jeopardizing the functionality of the system.

d. Software shall be fine-tuned through simulations & real life working conditions based on the extensive trials, associating user railways before putting the rake into commercial services. As it requires, instrumentation and expertise of Software Design Professional, software expert (s) of supplier shall be based at the work place along with the commissioning engineers so that all the software related issues are resolved before putting the rake into commercial service.

e. Quality and efficacy of Trouble shooting manual, software tools and software documentation shall be validated during extensive field trials. Final version of

these documents shall include the changes required based on the trials and experience of operating railways. This shall be approved by RDSO.

f. All the changes, thereafter, in software shall be approved by RDSO in consultation with user railways before actual implementation and the supplier must give software release which shall include brief description of the problem, logics, explanations, parametric changes etc. to the satisfaction of Railways.

g. Software documentation shall be provided to give the full understanding of the software function and operation. Documentation shall be complete, clear and concise, and include all modifications up to final acceptance. Documentation shall include software block diagram showing signal flow, logic, and hardware interfaces. A top level flow diagram and description of detailed operation shall be provided.

xv) Notwithstanding the contents of this specification, the supplier shall ensure that the equipment supplied by them is complete in all respect so as to enable the desired operation of the MEMU fitted with their equipment.

xvi) The specification has been prepared for the general guidance of the Supplier. Deviation from this specification may be proposed if it intends to improve the performance, utility and efficiency of the MEMU as a whole or part thereof. All such deviations shall be accompanied with complete technical details and justification for the proposed deviation.

### 3.3 AMBIENT CONDITIONS / OPERATING CONDITIONS

MEMUs are currently running in NR, NER, ER, ECR, SECR, SCR, SWR, SR and NCR etc. These EMUs/MEMUs are operating at 25 kV AC OHE voltage fed through pantograph and vacuum circuit breaker mounted on the roof of the motor coach. The incoming power supply is fed to the primary of the main transformer and stepped down to a lower voltage, converted into AC voltage through IGBT based Converter and inverters and fed to four (04) parallel connected 3 phase traction motors.

For AC MEMU, the configuration of the coaches shall be of either 8/12/16/20/24. Indicative train formation for 8 and 12 car is as shown below:

**8 car Formation:**

**DMC-TC-TC-TC-TC-TC-TC-DMC**

**12 Car Formation:**

**DMC-TC-TC-TC-TC-TC-TC-DMC- TC-TC-TC-DMC**

DMC: Driving Motor Coach

TC: Trailer Coach

The equipment shall be designed to work satisfactorily under following environmental conditions: -

| | |
|---|---|
| Relative Humidity | Up to 98% saturation during rainy season which may be as long as five (5) months. |
| Ambient temp. | i) Max. 50º C<br>ii) Min. 0$^{o}$C |
| Average annual ambient temperature | 35°C. |
| Maximum temperature inside HT compartment of motor coach | Max. 55º C. |
| Stationary rake temperature | The temperature of stationary rake may go as high as 70-75 $^{o}$C. The equipment shall not be adversely affected in any way due to exposure to such high temperatures. Supplier shall furnish the precautions taken in equipment/ component selection in order to conform to this requirement. |
| Altitude | At any altitude between 0 and 1200 m above mean sea level. |
| Rainfall | Very heavy and continuous (up to 2500mm during rainy season) All underslung equipment shall be designed suitably to ensure its normal working even in adverse conditions as above.<br>The equipment shall be so designed to run at 8 Km/h through water up to 203 mm above rail level, allowance to be made in addition for increase in the height of water level due to wave effect. In case of flood level increasing more than 203mm, the MEMU shall be made dead.<br>There are certain sections of the track that get flooded with water to standing depth of 400mm.<br>**The traction gear and other under slung equipment must be completely water proof to this height above rail level. During the peak flood** |

| | |
|---|---|
| | **condition water may reach up to floor level. The equipment shall not get damaged due to such flooding and it should be possible to rejuvenate the equipment with minor attention without any adverse effect on their performance**. |
| Atmosphere during hot weather | Extremely dusty, humid and salty.<br>The MEMU shall be working primarily in coastal area and thus shall be continuously exposed to highly corrosive, salty atmosphere along with industrial pollutants.<br>Special care shall be taken to ensure no damage to equipment due to deposition of atmospheric salts and industrial pollutants. Supplier shall enclose details of specific measures adopted to ensure the satisfactory working of equipment against the deposition of salts & industrial pollution. |
| Vibrations | The vibration levels at some intermittent points on the track may be higher than those specified by the relevant IEC publication (IEC 61373). The suspension system and the mounting arrangements shall be so designed that the equipment's performance is not adversely affected due to such high vibrations and shocks. |

### 3.4 STANDARDS

The equipment covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

The equipment to be furnished under this specification shall conform to latest issue (with all amendments) of specified standards.

In addition to meeting the specific requirement called for in Sections 2 of the Technical Specification, the equipment shall also conform to the general requirement of the applicable standards, which shall form an integral part of the specification. The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other. When the specific requirements stipulated in the specifications exceed or differ from those required by the applicable standards, the stipulation of the specification shall take precedence.

Other internationally accepted standards, which ensure equivalent or better performance than that specified in the standards referred, shall also be accepted. The bidder shall submit copies of such standards.

### 3.5 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

All equipment shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation. All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (wherever applicable) short circuit etc. for the equipment.

### 3.6 ENGINEERING DATA

#### 3.6.1 DRAWINGS

The contactor shall necessarily submit all the drawings/ documents unless anything is waived. The contactor shall submit 6 (six) sets of drawings/ design documents/ data/ test reports as may be required for the approval of the purchaser. All drawings submitted by the Manufacturer including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required, dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and interconnections between various portions of equipment and any other information specifically requested in the specifications.

Each drawing submitted by the Manufacturer shall be clearly marked with the name of the Customer and Project, the unit designation, the specifications title, the specification number, date of revision (if any), duly signed by the concerned technical person. If standard catalogue pages are submitted, the applicable items shall be indicated therein and should be made project specific. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the Manufacturer shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Purchaser, if so required.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Manufacturer's risk. The Manufacturer may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Purchaser. Approval of Manufacturer’s drawing or work by the Purchaser shall not relieve the manufacturer of any of his responsibilities and liabilities under the Contract.

All engineering data submitted by the Manufacturer after final process including review and approval shall form part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the Owner in Writing.

The title block of drawings shall contain the following information incorporated in all contract drawings

| |
|---|
| **1. Customer :** BHEL /Indian Railways |
| **2. Project:** DESIGN, DEVELOPMENT, MANUFACTURE, SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 25kV IGBT BASED THREE PHASE ELECTRICS (ON BOARD MOUNTED) FOR AC MEMUs. |
| **3. PO No.:** 029160577.T1720523 dated 15.01.2018. |
| **4. Main Contractor : Bharat Heavy Electricals Limited** |
| **5. BHEL Order No. & Date :** |

### 3.6.1.1 SIZE OF DRAWINGS

The drawings of the following parts shall be to the sizes indicated below

I. Equipment details – full size or half size
II. Motor Assemblies – 1:5
III. General Assemblies- 1:10

The dimensions, weight, capacity, etc. shall be in SI units. All drawings shall be submitted on CDs along with complete setup with software for reading and taking prints through desk top PC and suitable printer. In case the format is not compatible with AUTOCAD necessary customized hardware and software shall be submitted.

### 3.6.1.2 METHOD OF FILING OF DRAWINGS

To facilitate filing of drawings, it is essential that each drawing submitted for approval is marked so that it can be identified. The supplier is, therefore, required to ensure that all prints are marked legibly at the right hand bottom corner. The following information is required in respect of each drawing:

I. Supplier's drawing number.
II. Supplier's name and date of submission.
III. Contract no. given by the purchaser.
IV. Description of drawings.
V. Relevant Specifications

### 3.6.2 PHOTOGRAPHS

While the equipment is under manufacture, photographs shall be taken of the various assemblies and sub-assemblies in various stages of production. Photographs on digital media and videos shall also be furnished.

### 3.6.3 BINDING

Each set of tracings together with a set of photographs shall be suitably bound within a cover of superior quality durable materials with the title block printed on the outside of the cover.

## 3.7 MARKING OF EQUIPMENT & RATING PLATE

All main assemblies of the equipment shall bear serial number for identification and initials of the purchaser. Where the sub-assemblies/components of the main assemblies are not inter-changeable, the sub-assemblies shall also be marked with the serial nos. of the main assembly of which they form a part.

All equipment/cubicles shall contain rating plates of anodized aluminium with embossed letters. The rating plate will give detailed rating specification and identification of equipment. The details of rating plate of each of the equipment shall be as approved by RDSO.

## 3.8 INFRINGEMENT OF PATENT RIGHTS

BHEL and Indian Railway shall not be responsible for infringement of patent rights arising due to similarity in design, manufacturing process, components used in design, development and manufacturing of propulsion system & other equipment and any other factor which may be a cause such dispute. The responsibility to settle any issue lies with the manufacturer.

## 3.9 DOCUMENT SUBMISSIONS

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Purchaser would be discussed and finalized at the time of award. The following schedule shall be followed generally for approval:

| Sl.no. | No. of copies | Schedule |
|---|---|---|
| | Initial Submission Drawings, Data sheets, Type test Reports | At the time of submission of offer. |

| | | |
|---|---|---|
| | Furnishing of distribution copies of drawings in bound volume | 2 Weeks from the date of award. 3 copies for Railways plus 3 copies for BHEL. |
| | Furnishing of distribution copies of type test reports in bound volumes | Hard copy to be submitted 1 Week from the date of type test and total 3 copies for Railways plus 3 copies for BHEL to be given.<br>Soft copy to be submitted immediately after the completion of the test by email. |
| | Furnishing of distribution copies of Routine test reports | Hard copy to be submitted 1 Week from the date of routine test and<br>3 copies for Railways plus 3 copies for BHEL to be given. Soft copy to be submitted immediately after the completion of the test by email. |
| | CD/pen drive containing all documents including Installation, Operation & Maintenance manuals. | 2 Weeks from the date of award.<br>3 sets of hard copy and soft copy in editable format i.e. MS word/ MS excel. |

### 3.10 QUALITY ASSURANCE PROGRAMME

To ensure that the equipment and services under the scope of this Contract, whether manufactured or performed within the Manufacturer's Works or at his Sub-manufacturer's premises or at the Purchaser's site or at any other place of Work, are in accordance with the specifications, the Manufacturer shall adopt a suitable quality assurance program to control such activities at all points, as necessary. Such program shall be outlined by the Manufacturer and shall be finally accepted by the Purchaser after discussions before the award of Contract. A quality assurance program of the manufacturer shall generally cover the following:

a) Manufacturer's organization structure for the management and implementation of the proposed quality assurance program:
b) Documentation control system;
c) Qualification data of bidder's key personnel;
d) The procedure for purchases of materials, parts components and selection of sub-Manufacturer's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.

e) System for shop manufacturing and site erection controls including process controls and fabrication and assembly control;
f) Control of non-conforming items and system for corrective actions;
g) Inspection and test procedure both for manufacture and field activities;
h) Control of calibration and testing of measuring instruments and field activities;
i) System for indication and appraisal of inspection status;
j) System for quality audits;
k) System for authorizing release of manufactured product to the Purchaser
l) System for maintenance of records;
m) System for handling storage and delivery; and
n) A quality plan detailing out the specific quality control measures and Procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services rendered.

The Purchaser or his duly authorized representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the Manufacturer/'his vendor's quality management and control activities.

### 3.10.1 QUALITY ASSURANCE DOCUMENTS

The Manufacturer shall be required to submit the following all the Quality Assurance Documents as stipulated in the quality plan at the time of purchaser's inspection of equipment/ material.

## 3.11 TYPE AND ROUTINE TESTING & INSPECTION

1) The individual equipment, systems and sub systems shall be type and routine tested in accordance with the relevant RDSO/IEC/BS/DIN/JIS/IS or equivalent Specification inclusive of the mandatory and optional tests along with the special tests as specified.

2) All type tests shall be carried out at the Supplier's cost where ever performed in presence of and to the satisfaction of BHEL/RDSO/Indian Railways (IR)/ Third Party, who reserves the right to witness any or all of the tests.

3) Wherever any equipment, system, sub system is not specifically covered by an international recognized specification or test procedure, the tests which are acceptable to both to Supplier and to the IR's representative shall be devised.

4) Without prejudice to any provisions of the contract, the purchaser reserves the right to witness any or all of the type tests and to require submission of any or all test specification and reports.

5) The price of conducting all tests and additional type tests is deemed to be included in Bid price. In case any bidder indicates that he shall not carry out a particular test, his offer shall be considered incomplete and shall be liable to be rejected.

6) The Purchaser, his duly authorized representative and/or outside inspection agency acting on behalf of the Purchaser shall have at all reasonable times free access to the Contractors premises or Works and shall have the power, at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection if part of the Works is being manufactured or assembled at other premises or works, the Manufacturer shall obtain for the Engineer and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the Manufacturer's own premises or works. Inspection may be made at any stage of manufacture, dispatch or at site as the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

7) In all cases where the Contract provides for tests whether at the premises or at the works of the Manufacturer or of any Sub-Contractor, the Manufacturer except where otherwise specified, shall provide free of charge items such as labor, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Purchaser /Inspector or his authorized representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Purchaser Inspector or to his authorized representative to accomplish testing.

8) The inspection by Purchaser and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Manufacturer in respect of the agreed quality assurance program forming a part of the Contract.

9) The Purchaser reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site.

10) During the prototype tests/trials or services, if any problems arise or feedback information is obtained, which warrants a re-check of the design/manufacture/quality of the equipment and components, action will be taken as may be necessary by the Supplier to carry out the required investigations and to incorporate the improvements considered most appropriate to reach compliance with the specification without any extra costs to the Purchaser.

11) The prototype rakes fitted with the supplied equipment, shall be subjected to pre-revenue service trials. Service trials are intended to prove the satisfactory running performance of the supplied MEMU equipment and evaluate their reliability in service, ease of maintenance and operations. The performance of the equipment shall be assessed based on the experience gained during the service trials. Necessary modification as required and also as desired by the RDSO/Indian Railway shall be implemented in the series production without any extra costs to the Purchaser.

12) Before carrying out any modification, as found necessary on the basis of tests and trials, the drawings and execution plan shall be got approved from the RDSO.

### 3.12 MATERIALS AND WORKMANSHIP

Equipment materials and components shall be new, of high grade and good quality and be to the latest engineering practice. The material and workmanship throughout shall be in accordance with the purpose for which they are intended. Each component shall be designed to be consistent with its duty.

All the information concerning materials or components to be used in manufacturing, machinery, equipment, materials and components supplied, installed or used shall be submitted for approval. Without such approval the supplier shall run risk of subsequent rejection. The cost as well as time delay associated with such rejection shall be borne by the supplier.

### 3.13 PACKING AND STORAGE

All the equipment's shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. On request of the purchaser, the manufacturer shall also submit packing details/ associated drawing for any equipment/ material at a later date, in case the need arises.

While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken into account. The manufacturer shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharf age and other such charges claimed by the transporters, railways etc. shall be to the account of the manufacturer. Purchaser takes no responsibility of the availability of the wagons.

All coated surfaces shall be protected against abrasions, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device.

Supplier shall ensure that equipment shall be properly packed, blocked, padded, coated and protected so that it is not damaged due to possible mishandling. Storage requirements shall be clearly defined by the supplier. Packing shall be such that if required, long time storage at site should not deteriorate the performance of the equipment.

### 3.14 FIRE PREVENTION

i) The equipment's shall be designed to minimize the risk of any fire.
ii) Materials used in the manufacture of equipment's shall be selected to reduce the heat load, rate of heat release, propensity to ignite, rate of flame spread, smoke emission and toxicity of combustion gases.
iii) The Supplier shall comply with specification NF F 16-101: (Railway Rolling Stock Fire behavior "Choice of Material"), NF F 16-102: (Railway Rolling Stock Fire behavior "Material choosing, application for electric system" category A2), BS 6853 – 1999 Category II or DIN 5510, EN 45545(for rolling stoke design) CET.HL-2 or any other equivalent/superior international standard for fire safety plan in respect of their equipment. Whichever standard is selected for meeting the fire safety, the standard shall be declared and a copy shall be furnished to BHEL/RDSO.

### 3.15 MAINTENANCE MANUAL, SPARE PARTS CATALOGUE & MATERIAL SPECIFICATION

The detailed maintenance and service manual (including the trouble shooting directory shall be prepared for the various equipment's and 3 sets of hard copies & soft copy of the same shall be supplied free of charge.

Detailed spare parts catalogue listing all components manufactured or purchased by the supplier along with their rating, source & schematic position etc. (40 copies) each shall also be supplied free of charge.

The documentation shall be provided on compact discs & floppies (5 no's) along with relevant software and complete arrangements to read them or edit them in future to take prints in color.

### 3.16 MAINTAINABILITY

Supplier shall submit the basic maintenance schedules of the proposed equipment. Minimum interval between two maintenance schedules for the equipment supplied

under the specification in the depot shall be 90 days except for the pantograph strips and 3 years for major works in workshop/major depot.

It may be noted that the periodicity of the present maintenance schedules are as under: -

| | |
|---|---|
| I 'A' | 45 days |
| I 'C' | 180 days |
| POH | 18 months |

The maintenance programme prepared by supplier shall have the following objectives ascertaining the above periodicity of maintenance schedules:

a) Enhancement of EMU/MEMU availability

b) Minimization of maintenance costs

c) Minimization of coach downtime /MTTS (meantime to restore serviceability).

3.16.1 Based on the proposed maintenance schedules the supplier will submit average downtime on account of scheduled maintenance for the equipment to be supplied excluding the time required for transfer of rake to and from the maintenance depot. Ineffective on this account should not exceed Two percent. Supplier should also submit an estimate for the downtime for unscheduled maintenance in respect of equipment to be supplied. The supplier shall assess and submit the figure for 'total percentage Ineffective', in terms of percentage of rakes expected to be ineffective/unserviceable due to schedule and unscheduled repairs/maintenance of equipment supplied (excluding the time taken for transfer of the rakes to and from maintenance depot) against the total number of rakes fitted with the equipment under his scope of supply. This ineffective figure shall not exceed FOUR percent in any week (Monday-Sunday) calculated on 24 hourly basis. If during the test and service trial period of prototype rakes, it is experienced that downtime due to unscheduled repairs/scheduled maintenance of the equipment supplied is excessive, supplier shall be required to take suitable remedial measures to bring the ineffective figure within the limit submitted during the design approval stage without any cost."

3.16.2 Modular design principles shall be employed. Requirements for adjustments after module interchange shall be avoided except as required in the specification. All systems, components and structural areas serviced as part of inspection or periodic preventive maintenance shall be readily accessible for service and inspection.

**3.17 RELIABILITY**

In addition to meeting the performance requirements, the equipment, shall incorporate high standards of reliability to ensure that operating cost and operation performance is optimized.

# PERFORMANCE CERTIFICATE

**Name of firm: .....**

TO WHOMSOEVER IT MAY CONCERN

Sub : Confirmation letter for service performance

Dear Sir,

We hereby confirm that We ..... have manufactured _____ number of sets of .....(Name of Equipment with Model No.) for 3 Phase IGBT based EMUs/MEMUs/Metros/LOCOs.

We further confirm that …… number of sets of .....(Name of Equipment with Model No.) for 3 Phase IGBT based EMUs/ MEMUs/Metros/Locos are in satisfactory operation for railway rolling stock application.

Proforma for performance statement confirming above is also attached.

Yours faithfully

**For (**Name of Firm)

**IGBT BASED 3-PHASE DRIVE AC MEMU**
**PROFORMA FOR PERFORMANCE STATEMENT**

**Name of the Equipment:**
**Name of Firm :**

| S. No. | Order placed by (full address of Purchaser) | Order No. and Date | Description of Quantity of ordered equipment | Details of System for which equipment was supplied at Sr. No. 4 above to be given as follows | | | Value of Order | Date of Completion of Delivery | | Remarks indicating Reasons for late Delivery, if any | Qty. in Satisfactory Service on 3 Phase IGBT based EMU's/MEMUs/ Locos/Metros |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Supply System | Unit Formation | Speed Potential | | As per Contract | Actual | | |
| (1) | (2) | (3) | (4) | (5) | | | (6) | (7) | (8) | (9) | (10) |
| | | | | | | | | | | | |
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# Annexure-1

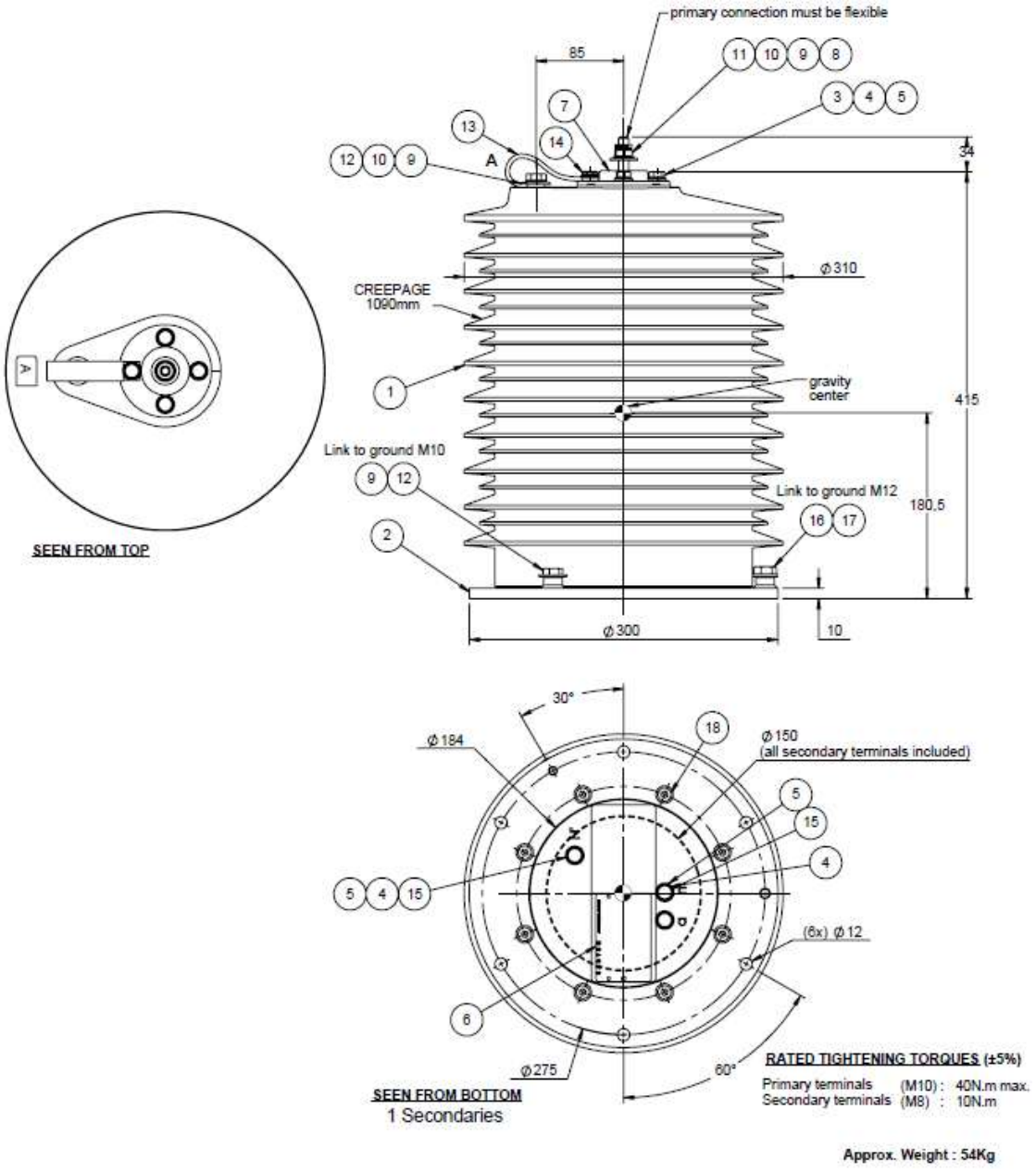


**Fig: Dimensional Drawing of Line Voltage Transformer**