



PLANT PURCHASE SPECIFICATION

JHANSI

PURCHASE SPECIFICATION
No. JS-28301

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25 KV HT CABLE ASSEMBLY & ACCESSORIES FOR AC EMU/MEMU TRANSFORMERS

1.1 SCOPE:

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of 25 kV HT Cable Assembly & Accessories.

The equipment is required for 25kV IGBT based three phase AC EMU/MEMU for M/s. Indian Railways

The scope shall also include the supply of complete documentation for approval of design, relevant drawings and calculations to the satisfaction of purchaser & RDSO and support documentation associated with the operation and maintenance of the equipment supplied.

1.2 BILL OF MATERIAL:

- 1) HT Cable with Cable Head Termination, Accessories for mounting and connections along with set of clamps for supporting HT Cable with coach.
- 2) HT Cable Cover Set in Passenger and Underframe areas.

1.3 ELIGIBILITY CRITERIA:

The Bidder should be an approved supplier of Indian Railway for 25 KV Cable head termination kit.

1.4 TECHNICAL SPECIFICATION OF HT CABLE ASSEMBLY & ACCESSORIES

25 kV HT Cable assembly & accessories are required for IGBT based 3-phase drive propulsion equipment for 25 kV single phase AC EMU/MEMUs of Indian Railways. The purpose of HT cable is to carry current from above Roof to the main transformer.

Governing specification for HT Cable and associated fitting is according to the latest version of RDSO Specification no. ELRS/SPEC/BL/0003 (Rev. 1).

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HT Cable Technical Requirements:

- a) HT Cable is to be used for 25 kV single phase AC EMU trains.
- b) Maximum Current carrying requirement is 80 Amps
- c) Length of HT Cable to be supplied for prototype rake shall be 10.5 mtr based on prototype rake, exact length to be supplied for further rakes shall be decided and informed.
- d) HT Cable Head termination with suitable earthing provisions shall be provided as per the RDSO Specification no. ELRS/SPEC/BL/0003 (Rev. 1).
- e) HT Cable termination on above Roof area to be done with suitable copper lug and sealing arrangement, which shall be in scope of supplier.
- f) For HT Cable termination on transformer side, suitable Elbow Connector, Basic insulating plug (BIP) with protection cover shall be in scope of supplier. Transformer bushing which is fitted inside transformer shall be in scope of BHEL.
- g) Supplier to propose suitable number of clamps to be used for partition wall & underframe. For Above Roof area there is a provision of 2 nos. of clamps. Supplier to propose suitable strength & dimensions of clamps to hold the HT cable and serve the intended purpose. Material of Clamps shall be Stainless Steel.
- h) Tentative no. of HT Cable Clamps are as follows:
 - 1) Above Roof - 2 nos.
 - 2) Partition Wall (Inside Coach) - 7 nos. (including 6 clamps inside HT Cable Cover)
 - 3) Underframe - 4 nos.
- i) Clamps shall be finalized after discussion with ICF/IR/Customer.
- j) Supplier to submit HT cable routing drawing (CAD drawing) on roof, HT compartment & underframe for approval by RDSO/ICF/Railway.

HT Cable Cover Set Technical Requirements:

Tentative HT Cable Route shall be above Roof, then HT compartment and finally underframe of Motor Coach. Stainless Steel (SS) HT Cable Cover shall be provided for the HT Cable routing in HT compartment. Tentative reference drawing of HT Cable Cover in Partition Wall is enclosed at Annexure-1. HT Cable Cover in SS material shall enclose one Current Transformer (in BHEL scope of supply) and a set of clamps (in supplier scope) for holding HT Cable. This SS Cover is welded to the Coach Partition Wall inside HT Compartment. Mounting bracket inside the SS cover for Current Transformer mounting shall also be provided by supplier. SS cover shall be supplied with Clamps (in welded/assembled form) which shall be further welded to the coaches at ICF. Tentative reference drawing is attached in fig. 1 on next page.

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Suitable SS material HT Cable Cover for Underframe area also shall be proposed by supplier for approval and is in scope of supply of HT cable supplier. HT Cable Cover in totality shall be finalized after discussion with ICF/IR/Customer.

Please note:

- In addition to the above mentioned technical requirements, the offered equipment must comply with all relevant IECs/other applicable standards.
- Supplier shall provide support for Installation of the HT cable head assembly including cover and clamps in the coaches at ICF.
- Design of all equipment and HT Cable including clamps and cover shall be finalized after ICF/RDSO/Customer clearance. Supplier shall provide support for approval of the design / drawings of the proposed system from ICF/RDSO/customer.

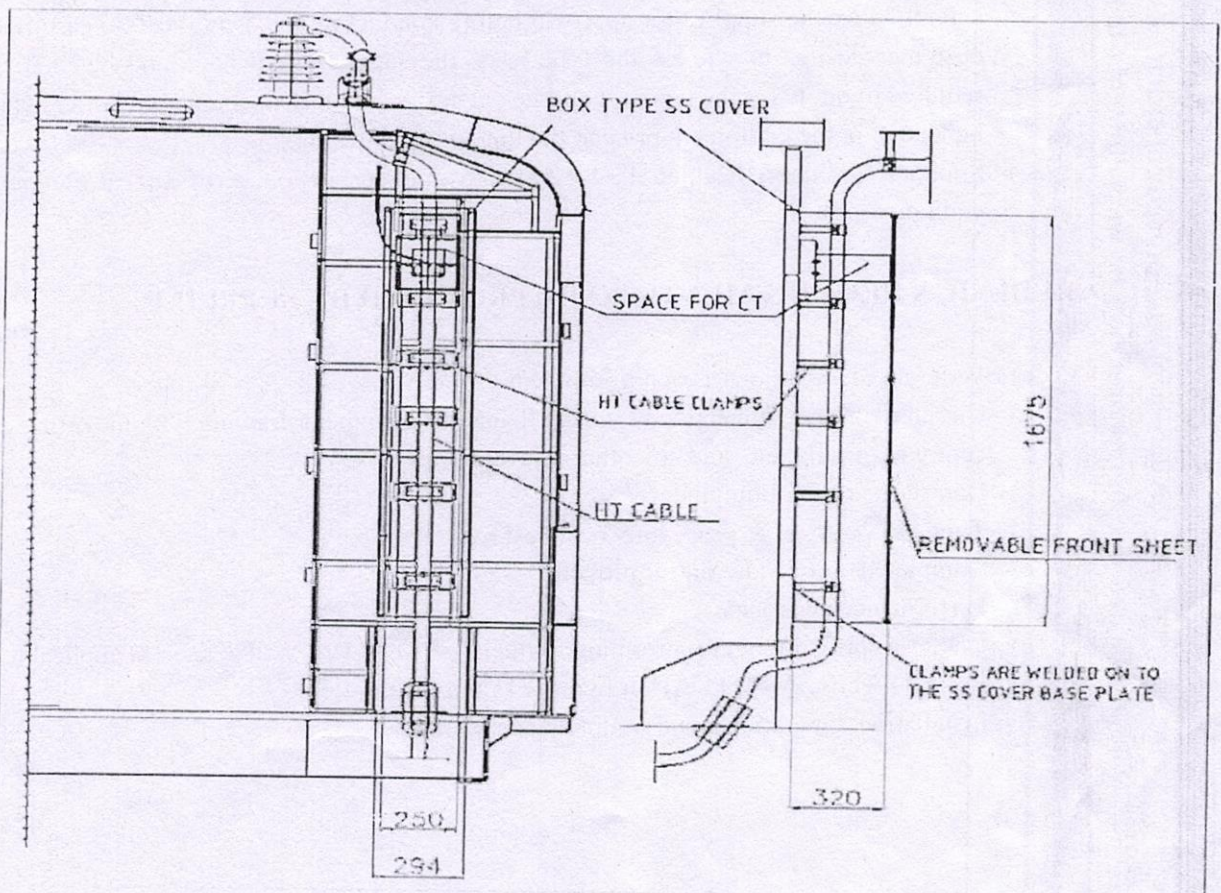


Fig 1: Tentative HT Cable Cover in HT Compartment

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1.5 EQUIPMENT TESTING:

- a) Type Test, if required, and Routine Test of the equipment needs to be conducted by the supplier. Type Test and Routine Test procedure has to be submitted for approval from RDSO/customer. It is the responsibility of the supplier to get the Type Test and Routine Test procedure approved by RDSO. BHEL shall provide necessary support for approval of type test and routine test procedure from RDSO. Type and Routine Tests shall be witnessed by representatives from BHEL/Customer/Third Party.
- b) Valid Type Test report is to be submitted for the equipment along with offer, if the equipment already type tested. In case BHEL or ultimate customer requires to conduct the Type Tests due to any reason, the type test shall be conducted by the supplier. Test procedure for Type Tests shall be submitted by the supplier for approval before conducting the Type Test. In case BHEL or 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.
- c) Supplier to submit Routine Test certificates and inspection certificate of equipment along with equipment.

1.6 DESIGN REQUIREMENTS TO BE PROVIDED BY SUPPLIER:

- a) Write-up/ description of each Equipment
- b) Circuit diagram, connection & wiring diagram, equipment drawing with mounting details, weights, centre of gravity, etc. and any other relevant drawings.
- c) Datasheets of the Equipments
- d) Type test protocol & procedure/Type test reports
- e) Complete Bill of Material for proven Design
- f) Performance certificate
- g) RDSO Approval letter (conforming to the latest RDSO/CLW/ICF spec as applicable)
- h) Project specific AUTO CAD drawing- 2D and 3D model
- i) Installation, Operational and Maintenance Manual

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1.7 PROJECT DETAILS AND GENERAL SPECIFICATIONS

- a) The traction equipment shall be suitable for operation with 25 KV AC, 50 Hz supplied by overhead contact wires. In case of EMUs, the control equipment shall be suitable to permit multiple operation up to 18 coach formation of 06 basic units here each basic unit shall comprise of 01 (Non/Driving Trailer coaches), 01 (one) motor coach and 01 trailer coaches.
- b) 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).
The stock fitted with the supplied equipment shall meet the operating/service conditions and performance requirements as specified Ambient conditions/operating conditions, of this specification respectively and shall be suitable for varying loading conditions.
- c) The entire equipment shall be designed to ensure satisfactory and safe operation under the Indian running conditions, 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.
- d) 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's mounted inside the car body IP54.
 The protection level (IP level) shall be furnished by the supplier during design approval.
- e) 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.
- f) All equipment 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.
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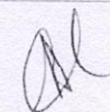
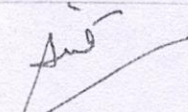
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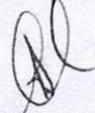
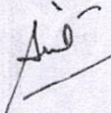
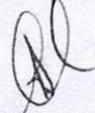
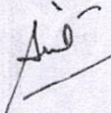
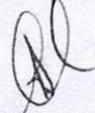
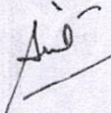
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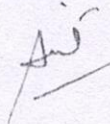
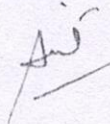
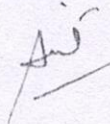


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h) If applicable, supplier shall study the currently available lubricants/cooling oils in India and employ these as far as possible. Full lubrication scheme and schedule for the equipment shall be submitted. Wherever the imported lubricants or cooling oil are used, Supplier shall study and furnish details of equivalent Indian lubricants/oil. i) The equipment shall be designed keeping in view that the EMUs/MEMUs operates with doors and windows wide open. j) The design shall also facilitate easy erection by means of suitable tools & equipment, inspection, maintenance and replacement of the various units comprising the equipment. k) 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. l) 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. m) 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. n) 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 EMU fitted with their equipment. o) 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 EMU as a whole or part thereof. All such deviations shall be accompanied with complete technical details and justification for the proposed deviation.				
1.8 AMBIENT CONDITIONS / OPERATING CONDITIONS				
EMUs 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 EMU, the configuration of the coaches shall be of either 9/12/15/18. Indicative train formation for 9 and 12 cars is as shown below:				
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9 car Formation: DTC-MC-TC-NDTC-MC-TC-TC-MC-DTC 12 Car Formation: DTC-MC-TC-NDTC-MC-TC-NDTC-MC-TC-TC-MC-DTC DTC: Driving Trailer Coach MC: Motor Coach NDTC: Non-Driving Trailer 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. - Max. 50° C / Min. 0° C ▪ Average annual ambient temperature - 35°C. ▪ Maximum temperature inside HT ▪ Compartment of motor coach - Max. 55° C. ▪ Stationary rake temperature - may go as high as 70-75° C. The equipment shall not be adversely affected in any way due to exposure to such high temperatures. ▪ Altitude level - upto 1200 m above msl ▪ 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. 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 EMU shall be made dead. There are certain sections of the track that get flooded with water to standing depth of 400mm. 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.						
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▪ Atmosphere during hot weather - Extremely dusty, humid and salty. The EMU shall be working primarily in coastal area and thus shall be continuously exposed to highly corrosive, salty atmosphere along with industrial pollutants. Special care shall be taken to ensure no damage to equipment due to deposition of atmospheric salts and industrial pollutants. ▪ 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. 1.9 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. 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. 1.10 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 aluminum 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.							
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1.11 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.

1.12 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.

1.13 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.

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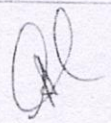
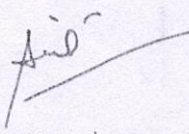
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ANNEXURE-A

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1.14 FIRE PREVENTION			
a) The equipment's shall be designed to minimize the risk of any fire. 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. b) 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 stock 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.			
1.15 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.			
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