GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

SPECIFICATION FOR B.G. SELF PROPELLED OHE RECORDING-CUM-TEST CAR (NETRA)
FOR ELECTRIC TRACTION

Issued by:

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SPECIFICATION FOR B.G. SELF PROPELLED OHE RECORDING-CUM-TEST CAR (NETRA) FOR ELECTRIC TRACTION

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Chapter-1

FOREWARD

On 25 kV a.c. electrified routes, different types of overhead equipment (OHE) have been provided, ranging from fixed type un-regulated OHE without articulation to the present auto tensioned sagged regulated OHE. In and around Mumbai area, 1500 V d.c. traction system also exists, which is under conversion to 25 kV a.c. system. However, the dynamic behavior of different types of OHEs with regard to current collection at different speeds has not been evaluated both qualitatively and quantitatively. Various parameters like height, stagger, wear of the contact wire, condition of OHE at the crossovers are at present measured/ checked manually and/or with the one available NETRA car, which is time consuming. Current collection performance is monitored by noticing the sparks at night and/or through OLIVER-G equipment. These methods suffer from errors in measurements and individual judgment. The single NETRA car available with IR is not adequate to scan the entire electrified network of IR which at present is 22224 RKM (as on 31.03.2012).

Indian Railways have embarked on a large-scale program of the electrification. To cater for increase in traffic, heavier freight trains are being introduced, which are to be hauled with consist of two or three electric locomotives. The speed of passenger trains is also being gradually increased to reach 160 km/h and beyond. The introduction of high speed trains as well as the increase in traffic will necessitate more frequent and accurate monitoring of OHE parameters.

The Self-Propelled OHE parameter recording cum-test car is required to measure and record various parameters of OHE and pantograph in static/ dynamic conditions and under live and non-live conditions of OHE, upto a maximum speed 200 km/h.

GENERAL REQUIREMENTS

1.1 EXPLANATORY

Throughout this specification the term –

1.1.1 RDSO: Research Designs and Standards Organization, Manak Nagar, Lucknow-226011 is hereafter referred to as RDSO.

1.1.2 IR: Indian Railways is hereafter referred to as IR.

1.1.4 Engineer: Director of RDSO is hereafter referred to as Engineer.

1.1.4 IRS: Indian Railway Standard is hereafter referred to as IRS.

1.1.5 IS: Indian Standard is hereafter referred to as IS.
1.1.5 ICF: Integral coach factory, Chennai is hereafter referred to as ICF.

1.1.7 ‘Purchaser’ means Railway Board on behalf of The President of Republic of India.

1.1.8 ‘Inspecting Officer’ means the persons, firms or departments nominated by the Purchaser to inspect the work on his behalf and the deputies of the Inspecting Officer so nominated.

1.1.9 ‘Contractor’ means the person, firm or company from whom the Purchaser may obtain any material or fittings to be used for the work.

1.1.10 ‘Contract Drawings’ means the drawings, which are included in Annexure- II of this specification for the guidance of the contractor.

1.1.11 IEC: International Electro-technical Commission

1.1.12 UIC: Union International Des Chemins de fer (International Union of Railways)

1.1.13 Horse Power (HP) shall be taken as metric horse power i.e. 75 kg metre/sec.

1.1.14 Tonnes (T) shall be taken as metric ton i.e. 1000 kg.

1.1.15 Overhead equipment is hereafter referred to as OHE.

1.1.16 Self Propelled Overhead equipment parameter recording cum test car is hereafter referred as OHE Recording Car

1.2 SCOPE OF THE SPECIFICATION AND SUPPLY

This specification covers the requirements of design, development, manufacturing and supply, testing, delivery and commissioning into service of suitable capacity of Self Propelled Overhead Equipment parameter recording cum test car with Stainless steel shell & Modern Interiors and high tech measuring equipments in completely assembled and furnished condition, hereafter referred as OHE Recording Car for operation on BG section of 1676 mm gauge of Indian Railways.

1.2.1 The scope shall also include the following:

a) Provision of all documentation and support material associated with the operation and maintenance of the OHE Recording Car.

b) Ongoing technical support and defects liability coverage until the completion of the warranty period and making good defects.

c) Training of engineers, operations and maintenance staff including providing the training materials, training kits and demonstration equipment.

d) Initial supply and installation of all consumables and materials required for testing and commissioning.
e) Provision of final drawings, design calculations and other documents including operations and maintenance manuals for review and acceptance by the Purchaser’s Representative.

1.2.2 The cars should have the following features:

a) Good aesthetics
b) High comfort levels
c) Passenger amenities
d) Ease of maintenance
e) Longer periodicity between overhauls
f) Low life cycle cost
g) Low weight
h) Flush level/ smooth exteriors.
i) Use of interchangeable, modular components
j) Extensive and prominent labeling of parts
k) High reliability
l) Fire and smoke detection
m) Use of fire retardant materials
n) Environment friendly
o) Maximum possible commonality of structure, components, equipments and sub-systems in the different types of cars.

1.2.3 This specification is intended to include everything requisite to the construction of OHE Recording Car, notwithstanding that everything required may not be mentioned herein, the supplier shall ensure that the OHE Recording Car is complete in all respect and fit for operation.

1.2.4 The OHE Recording Car shall be self propelled and shall have driving cabs on either ends. The OHE Recording Car shall have two DG sets of suitable capacity preferably underslung type, a well furnished air conditioned instrument room, observation dome and staff/ officer’s cabin including adequate lights and fans etc. Provision shall be made for keeping computers, UPS with batteries, other accessories necessary for recording and generating reports with adequate power supply points at convenient locations as per approved layout. Provision shall be made for observation dome with comfortable sitting arrangement to view interaction of contact wire and pantograph alongwith the fitment of load cell/ accelerometers, transducers/ sensors/ instruments etc. as required for the purpose. Cupboards shall be provided for storage of catalogues and spare parts. All items/equipments required to make the OHE recording car fully operational to measure and record the proposed OHE parameters will fall under the scope of supply of the successful tenderer, whether specifically mentioned or not. This includes final testing of the entire system including the commissioning trials over Indian Railway Track to check the overall efficacy of the system with desired precision/accuracy.
1.2.5 The measuring equipment and associated electronic interface shall be fit for measuring OHE parameters with car running at speeds up to 200 kmph with its own power and when coupled to a train.

1.2.6 Software packages along with the suitable hardware & system support for scrutinizing the design calculations, equipment ratings, performance evaluation & making simulation studies etc shall be submitted. The package shall be complete in all respect so as to enable RDSO to simulate all performance and operational related variables in India (RDSO).

1.2.7 The Supplier shall supply all materials, cartage, tackle, plant, spare parts, special tools and appliances which may be necessary for the complete and efficient installation, testing and commissioning of the new units at his own expense even if such material or work may not be specifically mentioned in this Specification. The Supplier shall also arrange installation, testing and commissioning of the OHE Recording Car under his complete supervision.

1.2.8 If there be any point of difference between the specifications and/or exhibited drawings that this specification fails to clarify, the tenderer shall submit each such item to RDSO for immediate clarification.

1.2.9 Any additional item of work or equipment which may be considered necessary by the purchaser, after placement of order, and during the process of manufacture shall be carried out by the successful tenderer on the terms and conditions mutually agreed to between the purchaser and successful tenderer.

1.2.10 Unless specified otherwise in this specification, cars shall meet all requirements of UIC in respect of car design. Where UIC specification does not exist relevant EN/IEC/DIN/BS standard should be followed.

1.3 GENERAL DESIGN REQUIREMENTS.
1.3.1 Deviation from this specification may be proposed if it intends to improve the performance, utility and efficiency of the OHE Recording Car as a whole or part thereof as options with separate prices. However, consideration of such deviations shall be at the discretion of the IR and shall be on the basis of merit. All such deviations shall be accompanied with complete technical details and justification for the proposed deviation.

1.3.2 The entire equipment shall be designed to ensure satisfactory and safe operation under the running conditions specified in Chapter-2 and especially under sudden variations of load and pressure as may arise under working conditions due to faulty operation and short circuits.

1.3.3 The design shall also facilitate easy erection by means of suitable tools and equipment, inspection, maintenance and replacement of the various units comprising the equipment.
1.3.4 All working parts of the control and auxiliary circuit, specifically electronics and PCBs, shall be suitably covered to keep them free from moistures and dust. The Bidder shall furnish the protection level.

1.3.5 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.

1.4 Examination of the Tender Offers.

1.4.1 To facilitate the examination of tender offer, the tenderer is required to offer comments clause by clause of this specification either confirming the acceptance of the clause and elaborating each details, where necessary, or indicating deviations there from. A comprehensive specification of the offered OHE Recording Car, covering functional description of the complete system, salient features and advantages of the offered system, details of technical support and training offered shall also be submitted along with the above comments.

1.3.1 Details of all Measuring Instruments, covering all technical and functional requirements, given in the Specification, shall be brought out by the tenderer, while quoting. List of Measuring Instruments shall be furnished along with the offer by the tenderer for scrutiny.

1.3.2 In the event a tenderer is unable to comply, either partially or fully, to any of the stipulations made in this specification, it must be brought to the notice of purchaser with full particulars of the deviations, technical details, cost implications and past service performance, etc.

1.5 Contractor’s Responsibility:

The contractor shall be entirely responsible for the execution of the contract strictly in accordance with the terms and conditions of the specification notwithstanding any approval which RDSO or the Inspecting Officer may have given:

- of the detailed drawings prepared by the contractor,
- of his Sub-contractors for materials, components and sub assemblies,
- of other parts of the work involved in the contract,
- of the tests carried out by the contractor / sub-contractor or RDSO or the Inspecting Officer.

1.6 CONTRACT SPECIFICATION

1.6.1 Copies of Indian Railway Standard Specification and Schedule of Maximum and Minimum Dimensions may be obtained on payment from the Controller of Publications, Government of India, Civil Lines, Delhi – 110054, India.

1.6.2 Copies of IS Specifications are available from the Bureau of Indian Standards, 9, Bahadur Shah Zafar Marg, New Delhi – 110002.
1.6.3 The tenderer shall submit a copy of English version of International specifications used for design and manufacture of OHE Recording Car.

1.7 Design Development and Approval of Drawings

1.7.1 The successful tenderer (hereafter called as contractor) shall develop the design based on the details given in this specification and sound engineering practices. The entire design & technical data along with calculations shall be submitted to RDSO within 45 days for approval before commencing construction of OHE recording car or placing orders on sub-contractors.

1.7.2 The design shall be based on S.I. Units.

1.7.3 From the information given in this specification and instructions of RDSO, the contractor shall prepare a full set of engineering drawings and submit the same to RDSO for approval.

1.7.4 When submitting drawings of a particular detail, other details depending on it shall be shown in juxtaposition.

1.7.5 Material specifications, manufacturing tolerances and other details, which are necessary for manufacture for each component shall be indicated on the drawings.

1.7.6 “Approval” to the drawing means the approval to the general adoptability of the design features. RDSO shall not be responsible for the correctness of dimensions on the drawings, materials used, strength or performance of the components. The contractor shall be wholly and completely responsible for all these variables. The contractor, when submitting proposals or designs for approval of the RDSO, shall draw attention to any deviation or departure from the specification involved in his proposals or drawings.

1.7.7 Drawing for approval shall be submitted in standard size (s) as per IS: 696 along with main calculation details in triplicate. List of drawings/calculations to be submitted to RDSO for approval before undertaking manufacture of prototype OHE recording car are given in ANNEXURE-I. Any other drawings of which manufacturer desire to obtain approval of RDSO shall also be submitted to RDSO.

1.7.8 The contractor shall develop the design based on the details given in this specification and sound engineering practices. The Supplier shall deliver all necessary data, system design parameters, key drawings, calculations, drawings and specifications documents in English language as required by purchaser for examination.

The detailed design and calculations shall cover:

- Technical details with supporting calculation for compressor
- Calculation for electric load capacity with details of Battery & auxiliary alternator
- Fire detection system
- Design of doors, Staff cabins, officer cabin, kitchen, Lavatories etc.
- Design of complete interiors including partitions, interior paneling, roof paneling, flooring, public address system, seat cushioning and covering, noise suppression measures, heat insulation.
- Interior and exterior colour scheme
- Design of seats
- Complete lighting system
- Electrical couplers
- Power generation equipment
- Thermal and noise insulation measures

1.7.9 To facilitate filing of drawings in RDSO, it is essential that each drawing prepared for the manufacture/operation/maintenance shall be marked so that it can be identified. The contractor shall, therefore, ensure that all prints submitted are marked legibly at the right hand bottom corner. The following information is required in respect of each drawing submitted:
   i. Contractor's drawing Number
   ii. Contractor's name and date of submission
   iii. Contract Number
   iv. Nomenclature of the OHE Recording Car
   v. Description

1.7.10 The Supplier shall be responsible for carrying out improvements and modifications as may be considered necessary after tests and trials at his own expense on all the equipment supplied, provided such modifications/improvements are decided to be necessary for meeting the specified requirements of reliability, performance, safety etc. jointly between Supplier and RDSO.

1.7.11 For the purpose of technical decisions on improvements/modifications etc. on equipment, the final authority from the purchaser’s side will be RDSO.

1.8 QUALITY ASSURANCE PLAN (QAP)

1.8.1 The tenderer should have valid ISO:9001:2008 certificate. The contractor shall formulate Quality Assurance Plan (QAP) detailing the methodology proposed to be followed to ensure quality product. QAP shall cover quality assurance procedures to be followed during all stages of design, planning, procurement, manufacture, testing, commissioning and servicing. The contractor shall define the role of each functional group in the organization for achieving the required quality of the products and submit a comprehensive document of QAP.

1.8.2 The Tenderer whose bid is accepted, shall be required to submit a “Quality Assurance Manual” by giving details as to how the quality of specific product
is proposed to be assured. Supply of the equipment shall commence only after “Quality Assurance Plan” has been approved by RDSO.

1.8.3 The above shall apply to the main contractor as well as sub-contractors.

1.9 INSPECTION

1.9.1 The whole of the materials, or fittings used for works covered by the specification shall be subject to inspection by the Inspecting Officer, and shall be to his entire satisfaction.

1.9.2 The Inspecting Officer shall have the power to:

1.9.3 Adopt any means he may think advisable to satisfy him-self that the materials or fittings specified are actually used throughout the construction.

1.9.4 Take samples for such tests, as he may consider necessary by an approved metallurgist selected by him, whose report shall be final and binding on the Contractors.

1.9.5 Visit at any reasonable time the Contractor’s works to inspect the progress and quality of the work and the Contractor shall provide free of charge all equipment, labors, gauges, etc. required by him for this purpose.

1.9.6 To reject any material or fittings that do not conform to the relevant specification or good practice, which shall be marked in a distinguishable manner, and shall be disposed of in such a manner as the Inspecting Officer may direct. The Contractors without extra charge shall replace such rejected parts.

1.9.7 Tests of materials and fittings shall as far as possible is carried out at the works of the makers of the materials or fittings. The Contractor shall provide such additional materials or fittings as may be required or arrange for test pieces to be incorporated in forging and castings as required by the Inspecting Officer and for their removal in his presence for test purposes. All tests in the works of the Contractor and their sub-contractors, independent tests shall be paid for by the Purchaser or the Contractor depending on whether the tests show that the material is/is not to specification.

1.9.8 No material shall be dispatched or packed until it has been passed by the Inspecting Officer, but such passing shall in no way exonerate the Contractor from their obligation in respect of quality and performance of the Car.

1.9.9 In the event of dispute between the Inspecting Officer and the Contractor, the decision of the Purchaser shall be final and binding.

1.10 TESTING OF OHE RECORDING CAR

1.10.1 The Supplier shall manufacture the OHE Recording Car in all respect and shall offer for testing before dispatch. The tests laid down in the specification shall be carried out. Functional tests on measuring equipments and their electronic interface shall also be conducted.

1.10.2 Successful tenderer shall submit complete details about the protocol.

1.10.3 Details of test scheme for the Car shall be finalized during design stage.
1.10.4 After instrumented trials, testing, modifications, if any, and RDSO clearance, intensive service trials for 500 Kms of running will be done.

1.10.5 During the tests/trials or during the guarantee period, if any problems are thrown up or feed back 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 & to ensure specified reliability and performance without any extra costs to the Purchaser.

1.10.6 Modifications mutually agreed to and complying with the specification, will be incorporated by the Supplier at his own cost in the OHE Recording Car in a manner approved by RDSO. Drawings incorporating the modifications as found necessary as a result of test and trial will be submitted to RDSO for approval before carrying out the modifications.

1.10.7 The Supplier shall further, notwithstanding any exercise by the Inspecting Officer of the power of superintendence, be responsible for the sufficiency of the packing, marking etc. of all imported parts of the car to ensure their delivery in India without damage.

1.11 SPECIAL OR PROPRIETARY FITTINGS

All royalty charges for the use of special or proprietary fittings embodied in the construction of the coaches shall be borne by the Contractors. A list of components for which royalty is paid, together with the names of the firms and the royalty paid shall be furnished to the Engineers.

1.12 PHOTOGRAPHS

1.12.1 Colour photographs of various assemblies and sub-assemblies for newly built OHE Recording Car shall be taken especially for the measuring equipments, shell, underframe, power pack and body in various stages of manufacture, and also for the parts, which cannot conveniently be photographed after assembly such as, body sidewall, end wall, roof framing, under-frame, measuring equipments etc.

1.12.2 After completion, side, end and three-quarter views of OHE Recording Car shall be taken, including views of the interior furnishings.

1.12.3 The photographs shall be not less than 380 mm x 255 mm for the side views of the complete coach, or less than 255 mm x 200 mm for other views.

1.12.4 The soft copy on compact disc (CD) and Pen Drive and three sets of prints of each shall be furnished to the Engineers, the prints being mounted on sheets to form complete set.
1.13 TRAINING ON VEHICLE

1.13.1 The contractor shall provide training at the manufacturer's place for at least four railway personnel for 15 working man-days so that they acquire full knowledge of major assembly/sub-assembly used in OHE Recording Car. The training shall be helpful in trouble-shooting, maintenance and operation of the Car.

1.13.2 Besides the above, adequate number of maintenance and operating staff shall also be trained in the homing shed during the commissioning of the OHE Recording Car.

1.13.3 The training will broadly cover the following aspects directly connected to the car and will be processed as on job training:

i. Design and development of OHE Recording Car.
ii. Manufacturing technology and process engineering of the OHE Recording Car including design and manufacturing of Jigs/Fixtures/Tooling.
iii. Quality assurance systems, quality plans and inspection procedures including gauges.
iv. Maintenance engineering and repair practices for OHE Recording Car bodies as far as available with contractor.
v. The contractor shall endeavor to, where necessary, arrange to train IR personnel in the premises of his suppliers in design, manufacture, quality control and commissioning.
vi. The living costs of the IR personnel and the to and fro travelling cost shall be borne by IR. The transportation between hotel and place of training will be provided by the Contractor. For any additional training over and above described, the contractor shall arrange training of IR personnel at the works of manufacture.
vii. The Contractor shall provide free of charge to IR personnel necessary information, working dress where needed, any safety glasses/equipment and supplies during the training period.
viii. The Contractor shall designate qualified specialists to advice and train IR technical personnel and explain relevant aspects, related to product.
ix. In case of illness or accident, the Contractor shall arrange for medical care in the best possible way, the cost of which shall be borne by IR.
x. During commissioning of the OHE Recording Car, technical experts of the manufacturer will fully and adequately train operators/maintenance staff nominated by the consignee.

1.14 TRAINING ON MEASURING EQUIPMENTS

The Contractor shall arrange to provide training on measuring instruments of the OHE recording car at their manufacturing works for four persons for a period of four weeks. The charges for providing these facilities (excluding travel, boarding and lodging) should be indicated separately. To and fro
expenses of the IR engineers and their boarding and lodging will be borne by the Indian Railways. The total duration of training for each engineer shall be:

(a) Two week (10 working days) in handling of imaging, recording sensors, and its interface through electronic instruments to on board computers and display of output on the display unit and reading and interpretation of tabular/graphical report generated by the system and correct interpretation of actual measured parameter using GPS.

(b) Two week (10 working days) in handling of other electronic instruments/systems/sub-systems of the OHE Recording Car.

1.15 SERVICE ENGINEERING

1.15.1 The contractor shall provide, at his own expense, the services of competent engineers during the guarantee period and also during the first major overhaul the OHE Recording Car. The service engineers shall be available for testing/commissioning of the OHE Recording Car, training of operating and maintenance staff. The service engineers shall also advise the Railways on maintenance, testing and operating facilities considered necessary for efficient performance of the Car.

1.15.2 The contractor shall submit list of equipment and facilities required for maintenance and overhaul of OHE Recording Car offered.

1.16 Special Tools for Maintenance

1.16.1 The Bidder will also offer separately special jigs, tools and instruments which shall be essentially required for maintenance of mechanical, electrical/electronics and pneumatic equipment. Essential equipment and facilities required for attending local damage to the stainless steel structure, and coach interiors etc. in case of accidental damages shall also be furnished. The Bidder shall explain the purpose/justification of the specialized equipment so offered. Bidder shall submit the lists of such tools, instruments jigs etc. separately for IR’s workshop carrying out major overhaul and for maintenance depot for carrying out regular maintenance and quote accordingly. The finalized lists of maintenance and additional tools shall be considered during commercial assessment of the bid.

1.16.2 The Supplier shall demonstrate to the IR, the satisfactory functioning of the tools, jigs & instruments supplied.

1.17 TESTING KIT

The contractor shall indicate testing equipment required for ensuring optimum performance and trouble free service of the car as well as their major assemblies and sub-assemblies. The tenderer with complete quotations shall submit details of testing kit/equipments.
1.18 SPARE PARTS

1.18.1 The tenderer shall submit a list of spare parts and special tools, both indigenous and imported, indicating the name and address of the manufacturers as detailed below:

List–A: Catalogue of unit spares, indigenous and imported, of the principal assemblies of the Car such as the diesel engine, transmission, compressor, measuring equipments etc. with price.

List–B: Recommended maintenance spares for two years initial requirements. The tenderer shall submit the list of such spare parts giving their detail description, specification, source of supply, part number of the supplier, service life and price of each part.

1.18.2 The tenderer shall be responsible for ensuring subsequent availability of spare parts for efficient working of the respective equipments.

1.18.3 A spare part catalogue listing all components manufactured or purchased by the tenderer shall be prepared with in 45 days of design approval. The contractor shall furnish one copies of spare parts catalogue to RDSO and two copies to the consignee free of cost.

1.19 COMMISSIONING OF OHE RECORDING CAR

1.19.1 The OHE Recording Car shall not be dispatched or packed until the Inspecting Officer has passed it. Such passing shall in no way exonerate the contractor from obligation in respect of quality and performance of the equipment. In the event of dispute between the Inspecting Officer and the Contractor, the decision of the Purchaser shall be final and binding.

1.19.2 The consignee shall inform the Contractor after the OHE Recording Car has reached at site. The OHE Recording Car shall be commissioned by the Contractor within 4 weeks after intimation by the consignee. The consignee will issue a commissioning certificate after it has been successfully commissioned.

1.20 MAKER’S CERTIFICATE

Copies of Maker’s certificate guaranteeing the performance of the Car shall be submitted in duplicate along with the delivery. Test certificates of major vendor items shall also be supplied.

1.21 INFRINGEMENT OF PATENT RIGHTS

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 complete system and any other
factor, which may cause such dispute. The responsibility to settle any issue lies with the manufacturer.

1.22 SERVICE CATALOGUES

1.22.1 Detailed operating manual, maintenance and service manual and driver handbook shall be specifically prepared for the OHE Recording Car and at least 3 copies each of the same shall be supplied free of charge to the consignee and three copies to RDSO along with DVD. The draft contents of the manuals shall be submitted for approval to RDSO within 45 days of design approval. These documents shall also be supplied on compact disc (CD) compatible to MS-Office software.

The manual shall include chapters on:
- General characteristics
- Technical data sheet of all the equipment offered as per Annexure-V.
- All the technical details of measuring equipments and their electronic interface.
- Vehicle control system schematics
- Car design and its details including under frame design
- Details of mounting of diesel engine, traction machine etc. & cooling system etc.
- Drawing of each sub system with interface details
- Procedure for user settable parameter alteration, fault data downloading and analysis etc.
- Maintenance and trouble shooting manual for all the equipment offered
- Fuel, oil and cooling water circuit.
- Grease, oil chart with specification and quantity
- Wiring diagram with complete illustration of components
- Controls and safety features & their test procedure,
- List of special tools, jigs and fixtures needed for testing, commissioning, maintenance and repair.

1.22.2 The manual shall include dis-assembly and assembly procedure with specific mention of any special tools required for carrying out the above work.

1.22.3 Manual shall include a separate chapter indicating the service and condemning/wear limits & tolerances for various assembly/sub-assembly, wherever applicable.

1.22.4 The manual shall contain a separate chapter pertaining to standard schedule of examination covering all equipments i.e. engine, transmission, axle drive, cardan shaft, controls, etc for trouble free day to day maintenance of OHE Recording Car as per maintenance norms.

1.22.5 A separate booklet containing Driver’s operating instruction accompanied by suitable illustration and diagram and lubrication chart shall be prepared and supplied.
1.23 Annual Maintenance Contract (AMC)

1.23.1 The Tenderer shall quote for AMC of all Equipments/Components of diesel engine, transmission system, compressor & measuring system such as Transducers, Load Cells, Strain Gauges, High Resolution Camera, On Board Computers, Laser Printers and Plotters, UPS and other Interface Equipments. The Annual Maintenance shall be for 10 years after warranty period is over. The Tenderer shall quote year wise rates of AMC detailing the various maintenance schedules enlisting the requirement of material/ spare parts, consumables (excluding HSD oil, lube oil, grease etc) and services to be rendered by him in regular intervals. All these materials, spare parts, consumables and labour requirement shall be arranged by the successful Tenderer during the course of AMC. The AMC shall be comprehensive for all Equipments covering scheduled as well as breakdown maintenance. The Tenderer shall keep adequate spares in stock accordingly. AMC shall be inclusive of replacement of parts, if required, either due to breakdown or due to regular wear and tear.

1.23.2 The cost of OHE Recording Car, including the AMC cost shall be considered while evaluating the inter-se tender position. It shall be compulsory for the Tenderer to quote for AMC without which the offer shall be summarily rejected.

1.23.3 Tenderer shall submit various maintenance schedules such as Daily/ Weekly, Monthly, Quarterly, Half yearly and Yearly schedules of all Equipments along with the offer.

1.23.4 During warranty period, scheduled maintenance such as Daily/Weekly checks, Monthly, Quarterly, Half yearly and Yearly schedules of Equipment/ Components shall be done by the successful contractor for which no extra cost shall be paid by the Railways.

1.23.5 In case of failure of any Equipment, during Warranty as well as AMC period, it shall be repaired or replaced within reasonable time not exceeding 05 days from the day of reporting by the consignee. After this period of 05 days, penalty at the rate of Rs. 5000 (Rupees Five Thousand) per day (flat) shall be imposed on the contractor for each day, or it’s part thereof.

1.23.6 The AMC Agreement shall be entered separately with each Zonal Railway as per the accepted rate of the Contract.
Chapter-2

DIMENSIONAL OPERATING & OTHER REQUIREMENT FOR OHE RECORDING CAR

2.1 Climatic Conditions

It shall be capable of continuous operation during the varying atmospheric and climatic conditions occurring throughout the year in India. The range of climatic conditions is as follows:-

<table>
<thead>
<tr>
<th>Atmospheric Temperature</th>
<th>Metallic surface temperature under sun: 75ºC max and in shade 55 ºC max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity</td>
<td>100% saturation during rainy season</td>
</tr>
</tbody>
</table>
| Reference site condition| i) Ambient Temp : -10ºC to 50º C  
                           ii) Humidity : 100%  
                           iii) Altitude : 1000 m above mean sea level, 2000 m in J&K area. |
| Rain fall               | Very heavy in certain areas. The vehicle shall be designed to permit its running at 10 kmph in flood water level of 102 mm above rail level |
| Atmosphere during hot weather | Extremely dusty and desert terrain in certain areas. The dust concentration in air may reach a high value of 1.6 mg/m³. In mainly iron ore and coalmine areas, the dust concentration is very high affecting the filter and air ventilation system |
| Coastal area            | The vehicle and its component shall be designed to work in coastal areas in humid and salt laden atmosphere with maximum pH value of 8.5, sulphate of 7 mg per litre, max. concentration of chlorine 6 mg per litre and max conductivity of 130 micro Siemens/cm. |
| Vibration               | The equipment, subsystem and their mounting arrangement shall be designed to withstand satisfactorily the vibration and shocks encountered in service as specified. High level of vibration and shocks. Accelerations over 500 m/s² have been recorded at axle box level for long periods during run. Vibrations during wheel slips are of even higher magnitude. |
| Wind Pressure           | High wind speed in certain areas, with wind pressure reaching 200 kgf/m² |

2.1.1 The equipments and their arrangement shall withstand satisfactorily, the vibration and shocks normally encountered in service which are as below:-

(a) Maximum Vertical Acceleration 3.0 g  
(b) Maximum Longitudinal Acceleration 5.0 g  
(c) Maximum Train Acceleration 2.0 g  

(g: Acceleration Gravity)
2.2 The OHE recording car shall conform to the following dimensional and operational requirement:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Track gauge</td>
<td>1676 mm</td>
</tr>
<tr>
<td>2</td>
<td>Minimum radius of curve</td>
<td>175 m. It should also be capable of negotiating</td>
</tr>
<tr>
<td></td>
<td></td>
<td>i) a radius of 213m in case of 1 in 8-1/2 BG turnout with 6.4m over-riding switch.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii) 175 m radius in case of 1 in 8-1/2 scissors crossing.</td>
</tr>
<tr>
<td>3</td>
<td>Maximum super elevation</td>
<td>185 mm</td>
</tr>
<tr>
<td>4</td>
<td>Maximum Super-elevation deficiency</td>
<td>100 mm</td>
</tr>
<tr>
<td>5</td>
<td>Maximum wind pressure</td>
<td>200 kg/m²</td>
</tr>
<tr>
<td>6</td>
<td>Maximum permissible wheel base length of the OHE Recording Car, over hang beyond bogie center, buffer height draw bar height</td>
<td>These shall conform to Indian railway, schedule of dimension 1676 mm gauge (BG) Revised 2004 (with latest amendment). Adequate clearance shall be allowed so that no component of the OHE recording car shall infringe a minimum of 102 mm above rail level with wheels in fully worn-out conditions, full deflection of springs and effect of dynamics.</td>
</tr>
<tr>
<td>7</td>
<td>Maximum Axle load</td>
<td>20.32 t</td>
</tr>
<tr>
<td></td>
<td>(The maximum axle load shall not exceed 20.32 tonne in any case and preferably shall be as less as possible)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>i) Maximum Speed under its own power.</td>
<td>110 km/h</td>
</tr>
<tr>
<td></td>
<td>ii) Maximum speed when coupled to a train</td>
<td>150 km/h</td>
</tr>
<tr>
<td>9</td>
<td>Brakes</td>
<td>All wheels with clasp brakes.</td>
</tr>
<tr>
<td>10</td>
<td>Service Braking</td>
<td>Pneumatic</td>
</tr>
</tbody>
</table>

i) Period of continuous running at 105 km/h on generally tangent track followed by frequent to and fro movement at walking pace for 1-1/2 h).

ii) Period of continuous running at 40 km/h up or down gradient of 1 in 60 to be followed by frequent to and fro movement up to 5 km/h for 1-1/2 h on same gradient with speed control.
iii) Performance in monsoon and squally conditions. Un-restricted

iv) The OHE Recording Car shall be capable of running at a speed of 25 km/h on 1 in 33 up gradient.

v) The emergency braking distance (EBD) for fully loaded (20.32x4=81.28 t) OHE Recording Car from maximum speed of 110 kmph to zero shall not be more than 800 m on flat section. The contractor shall also submit calculation for EBD on 1 in 33 down gradient.

2.3 MAXIMUM MOVING DIMENSION.

| Maximum moving Dimensions | Maximum moving dimensions shall conform to diagram 1D of Indian Railway Schedule of Dimension (SOD) 1676 mm gauge (BG) revised 2004 (With Latest Amendments) with the pantograph and platform in lock down condition. Infringements, if unavoidable and fully justified, may be considered, if within the limits shown in SOD 1676 mm gauge (BG) revised 2004. |

2.4 TECHNICAL DETAILS OF EXISTING OHE OF INDIAN RAILWAYS

2.4.1 25 kV a.c., 50Hz single phase Traction system

A simple polygonal type overhead equipment, comprising of single catenary and contact wire, is automatically tensioned. The catenary has 19 strands made of cadmium copper with a cross section of 65 sq.mm. The grooved contact wire is hard drawn electrolytic copper of 107 sq.mm cross section. Solid copper droppers, 5 mm in diameter, with a normal spacing of 9 m. according to degree of curvature. On straight track, the contact wire is registered at the supports on the contact plane by 200 mm transverse on either side of the center line of track. The stagger is limited to 300 mm on curves. At overlaps stagger may go upto 650 mm.

On secondary lines regulated tramway type construction consisting of contact wire only tensioned at 1200 kgf with bridle wire provided at support points to reduce sag, is used.

Normal vertical and lateral electrical clearance of 320 mm has been adopted, with passing clearances i.e. of short time duration of 270 mm and 220 mm respectively, as per Chapter-V A of Schedule of dimensions, BG.

The normal height of the contact wire above the rail level is 5.50 m but at loco sheds and inspection pits, the height is kept as 5.8 m. On critical locations, such as tunnels, road-over bridges the contact wire height is kept as low as 4.65 m (minimum). Any change in the height of the contact wire is made gradually and the maximum gradient does not normally exceed 3 mm/m on main lines and the 10 mm/m elsewhere. The variation of gradient
on adjacent spans is not more than 1.5 mm/m for main lines and 5 mm/m on secondary tracks.

The vertical distance between the catenary and the contact wire (called encumbrance) is 1.4 m at support and is maintained except at turnouts, overlaps and near overline structures and tunnels, where it is suitably reduced. The distance from the center of the track to the nearest face of an overhead equipment support mast is normally 2.50/2.80 m on straight track. This distance is increased by necessary curve allowance on the curves. This distance is also more than the normal 2.50/2.80 m in the vicinity signals for better visibility.

A cantilever assembly mainly comprising of high tensile steel tubes and solid core porcelain insulators is attached to the traction mast with suitable mast fittings. The catenary is freely suspended from the cantilever assembly and the contact wire is registered at the required position by an aluminum steady arm. The complete cantilever assembly upto solid core porcelain insulator is live at 25 kV, 50 Hz AC. system.

In tunnels due to restricted head rooms, the encumbrance is reduced as required, the minimum being 250 mm. approximately.

The tension length of the catenary and contact wires are normally 1500 m and distance between overlaps being 1300 m (approx.). An anticreep i.e. a fixed point is provided on the catenary approximately at the mid point of each tension length. In a regulated equipment as adopted on Indian Railways, a constant tension of 1000 kgf is maintained on the catenary and the contact wire by counter weights through an auto tensioning device. Unregulated OHE is also in use, but normally in yards only. The contact wire tension for tramway OHE used in secondary lines is 1200 kgf.

At un-insulated overlaps, the air gap between the two wires is 200 mm. At insulated overlaps, similarly the two overhead equipments are separated by an air gap normally of 500 mm.

Turnout and crossovers are equipped with separate OHE and the take of points are invariably arranged in such a way so as to have smooth passage of pantograph. The turnouts and crossing from secondary tracks are provided with similar arrangement or with crossed type of equipments where other OHE has no overlapping span.

2.4.2 OHE PARAMETERS

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>OHE</td>
<td>Simple Polygonal OHE (regulated)</td>
</tr>
<tr>
<td>2.0</td>
<td>Span</td>
<td>72 m (Max.) on tangent track suitably reduced on curves. Maximum variation between two adjoining span is 18 m</td>
</tr>
<tr>
<td>3.0</td>
<td>Tension</td>
<td>1000 kgf. for catenary and 1000 kgf for contact wire</td>
</tr>
<tr>
<td>4.0</td>
<td>Contact wire</td>
<td>107 mm² Hard Drawn Grooved Copper Contact Wire</td>
</tr>
<tr>
<td>5.0</td>
<td>Catenary (Messenger Wire)</td>
<td>65 mm² cadmium copper</td>
</tr>
<tr>
<td>6.0</td>
<td>Height of Contact Wire</td>
<td>7450 mm (Conventional Height - 5500 mm, High Rise Height - 7450 mm)</td>
</tr>
<tr>
<td>7.0</td>
<td>Height of Catenary Wire</td>
<td>8950 mm</td>
</tr>
<tr>
<td>8.0</td>
<td>Implantation</td>
<td>4750 mm at platforms 2360 mm to 3300 mm (other than platforms)</td>
</tr>
<tr>
<td>9.0</td>
<td>Maximum blow off</td>
<td>415 mm</td>
</tr>
<tr>
<td>10.0</td>
<td>Stagger of contact wire</td>
<td>200 mm on straight track &amp; 300 mm on curves.</td>
</tr>
<tr>
<td>11.0</td>
<td>Relative movement of pantograph with reference to contact wire.</td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>Dynamic</td>
<td>Normally the contact wire is within the 520 mm zone on either side of the track centerline i.e., 1040 mm which is the flat zone of the pantograph. However, during wind conditions the contact wire may go beyond this flat zone extending up to 800 mm on either size of the center line i.e., to cover a range of 1600 mm. (taking into account other factors such as oscillations, loose joints etc.)</td>
</tr>
<tr>
<td>ii)</td>
<td>Static</td>
<td>For heavy wind conditions 860 mm from the centreline of pantograph is taken in to account.</td>
</tr>
<tr>
<td>12.0</td>
<td>Mid span sag</td>
<td>Partly 50 mm to 100 mm varying from span 27 m to 72 m</td>
</tr>
<tr>
<td>13.0</td>
<td>Condemnation size of contact wire</td>
<td>74 mm² (reduction in vertical height from 12.24 mm to 8.25 mm)</td>
</tr>
<tr>
<td>14.0</td>
<td>Gradient of contact wire</td>
<td>The maximum contact wire gradient is 3 mm per meter and permissible variation in gradient over 2 consecutive spans is 1.5 mm per meter. (variation of 1.5 mm/m on consecutive span.)</td>
</tr>
<tr>
<td>15.0</td>
<td>Spacing of droppers</td>
<td>First dropper 2.25 m from support, second one is 4.50 m/6.75 m and thereafter the droppers are at 9 m spacing.</td>
</tr>
<tr>
<td>16.0</td>
<td>Permissible uplift of contact wire</td>
<td>60 mm (at registration arm)</td>
</tr>
</tbody>
</table>

2.4.3 The car and its principal assemblies shall be designed and manufactured to give satisfactory performance in the tropical climate, having very dry & dusty regions in arid zones of the country, to humid coastal areas and extreme cold climate of the northern region.

| Operation time | Day & Night |
| Operation Duty | All measuring devices installed shall be suitable for continuous working on live or non-live OHE under all atmospheric conditions throughout the year. |
| Nominal system Voltage of Overhead contact wire. | 25kV AC. single phase, 50Hz |
PARAMETERS TO BE MEASURED

3.1 The OHE Recording Car should be able to measure and record the required parameters in the speed range 0 – 200 kmph, when running in self propelled mode/coupled to a train.

3.1.1 The OHE Recording Car shall be self contained and completely equipped with all measuring/recording facility and there shall be no dependence on external source.

3.1.2 The measurements shall be made under live or non-live condition of the OHE, during day and night.

3.1.3 There shall be provision for automatic sending of recorded data from the on-board computer to the nominated Railway Official sitting at the Remote Control Centre through internet. The system shall generate two types of the reports i.e. for Priority-1 and Priority-2 faults. Priority-1 report shall have all major abnormalities needing immediate attention and priority-2 shall have rest of the abnormalities. An alert message (SMS) for priority-1 faults shall be generated by the on-board computer and shall be sent to the nominated mobile numbers. Limits as well as classification of faults into priority-1 and priority-2 shall be decided by RDSO at the design approval stage.

3.1.4 The pantograph of the OHE Recording Car may be fitted with instrumentation such as transducers, load cells and strain gauges etc. as required but such fitment shall not materially affect the static/ dynamic performance of the OHE Recording Car pantograph. The sensors are preferably to be installed on the roof of car and non-contact measurement shall be preferred. The transducers shall be properly protected against mechanical, environmental and electrical interferences. The cameras shall have high resolution high frequency suitable for capturing of images at the specified speeds. The cameras and other equipment shall be protected for ingress of dust and water with IP -68 Protection.

i. For parameters like contact wire height, stagger, slope and thickness/diameter of contact wire, only contact-less measurement system employing state of the art technology shall be acceptable conforming to environmental standards. The system shall be designed according to electromagnetic compatibility, Shocks and vibrations and shall have no moving parts, completely sealed and rugged construction.

ii. The communication between exterior/roof mounted and interior/ control room components is made by an Ethernet Network and physical connection is made by optical fiber. All cables on the roof of OHE
Recording Car which are connected to ground level shall be put in a metallic grounded protection pipe.

iii. The system shall be precise and needs less frequent calibrations.
iv. The tendered shall submit a detailed scheme of the proposed system with technical details including dimensional requirement and performance report of the system supplied and commissioned over world wide Railways.

3.2 All processed information shall be made available in the instrument/recording room of the OHE Recording Car. The connections from roof of the car to the instrumentation room inside the cab shall be rigid enough to avoid any failure due to poor connectivity during movement of OHE recording car due to vibrations. Principles/methods used for the measurements as indicated in each of the following clauses are only suggestive and the successful tenderer should employ state-of-art technology capable of high accuracy and precision in measurement and recording. All corrections/compensations due to bogie, body and pantograph oscillations should be built into the measurement methods for giving better accuracy/precision in measurement and recording. The parameters that the OHE Recording Car is required to measure and monitor are detailed as follows:

a) Stagger of the Contact Wire
Stagger is defined as the distance of the contact wire from the center-line of pantograph, measured transverse to the track. (Suitable compensation shall be made for transverse oscillations of the locomotive/OHE Recording Car which affect the center line of the pantograph from the vertical). The system employed should enable measurement of stagger of two contact wires simultaneously (at overlaps and turnouts) up to a limit of ± 500 mm. The stagger of contact wire may be measured using any non-contact measurement method. The accuracy of stagger measurement should be minimum + 10 mm. Sampling distance for Stagger measurement shall be 200 mm.

b) Height of the Contact Wire
The height of the Contact Wire is vertical distance of its underside from the rail level and it varies from 4500 mm to 7500 mm. The height measurement should be corrected for car-body movement. Height of contact wire may be measured using any non-contact measurement methodology. The OHE Recording Car shall be able to measure heights of both contact wire of main line OHE and of Turnout OHE to ensure a gap of 50 mm at support points at obligatory structures(out of run OHE to be higher than main line OHE). This is essential to avoid pantograph entanglement with OHE. Continuous measurement of main line and Turnout OHE is required at such locations. The accuracy of height measurement shall be minimum + 10 mm. Sampling distance shall be 200 mm.

c) Measurement of Contact Wire Thickness
Thickness implies the diameter of Contact Wire. The diameter of new 107 mm² size contact wire is 12.24 mm and its condemning limit is 8.24 mm. Provision for measurement of diameter of Contact Wire of size 150 mm² and 193 mm² shall have to be made in the system. The measurement of diameter of contact wire may be made using any non-contact measurement method. The accuracy of contact wire thickness measurement should be minimum + 0.2 mm. Sampling distance should be 10 mm.

d) Gradient (slope) of the Contact Wire
The gradient of the contact wire is the rate of change of height expressed in mm/m of distance. This may be calculated based on variation in height of contact wire and distance travelled. Alternately, contractor’s design can also be considered, subject to meeting the requirements. The accuracy of gradient (slope) of the contact wire measurement should be minimum + 0.5 mm per 50 meter.

e) Measurement of Setting Distance (Implantation)
Setting Distance is distance measured from centre line of track to the inner face of traction mast. This varies in the range of 2100 mm to 5000 mm. System should be able to measure the setting distance in accuracy level of + 10 mm. System should be able to have Data storage of at least 50 lakh masts and transfer it for printing of reports.

f) Contact Force:
Continuous measurement of the contact force between the pantograph and the contact wire, which may differ from the upward force of the pantograph, due to oscillations of the contact wire, shall be made by suitable transducers installed on the pan of the pantograph. Force sensors shall be small and lightweight so as not to affect the aerodynamic uplift and current collection property of the pantograph.

g) Panto acceleration.
The vertical acceleration of pantograph as well as its vertical displacement shall be measured continuously when the OHE car is in motion. The lateral acceleration as well as horizontal sway of the pantograph pan, with reference to the central line of the pantograph in static condition shall also be measured continuously.

h) Body vertical acceleration.
The measurement of body vertical acceleration shall also be done continuously.

(i) Accelerometer fitted to underside of OHE car body. Any track irregularity which can affect the vertical movement of the OHE car body and hence its effect on pantograph can thus be recorded.
(ii) Four linear sensors with differential transformers (one on each spring) used for measurement of compression of primary suspension. The sum of four voltage outputs by sensors provides knowledge of vertical movement of bogie. The tilt information is obtained by finding difference between sum of the two signals from the left side & sum of the two signals from the right side.

Any other method, which is more accurate and suitable to measure at higher speed of recording car, may be offered. If the tenderer feels that his proposed method is superior to the methods given above, Tenderer have to submit the detailed procedure and justification for acceptance of the purchaser; contractors’ design should have given satisfactory performance for a minimum period of two years on railway networks elsewhere.

Typical vertical acceleration values in respect of comparable vehicles have been found to be in the order of 0.32g; the criterion limit however is 0.55g.

i) Body lateral acceleration.
The measurement of body lateral acceleration may be carried out by either of the following three arrangements:

(i) Accelerometer fitted to underside of OHE car body. This will detect lateral impulses in the OHE car body which if excessive shall reflect on the stagger measurement.

(ii) Lateral motion measured by two linear potentiometers placed symmetrically about the bogie axis of rotation. The half sum of the two voltages shall give the lateral motion, independently of bogie rotation.

Any other method, which is more accurate and suitable to measure at higher speed of recording car, may be offered. If the tenderer feels that his proposed method is superior to the methods given above, Tenderer have to submit the detailed procedure and justification for acceptance of the purchaser; contractors’ design should have given satisfactory performance for a minimum period of two years on railway networks elsewhere.

Typical lateral acceleration values in respect of comparable vehicles have been found to be in the order of 0.27g; the criterion limit however is 0.55g.

j) Loss of Contact:
The quality of current collection is measured in terms of loss of contact between the Pantograph and the Contact Wire, as indicated below:
i. The number of times the contact is interrupted, while the OHE Recording Car is in motion; and.
ii. The duration of contact loss and its intensity for which the contact has been interrupted while the OHE Recording Car is in motion.
iii. Normal static pressure setting of Panto graph is at 7.00 kg/cm².
iv. The threshold value for Contact Loss is 4.5 kg/cm² pressure of Pantograph.

The contact losses, locations and their duration are to be measured and recorded continuously while the OHE Recording Car is in motion. Contact loss ratio shall be calculated by dividing the sum of total Contact loss duration with total duration of recording. The contact loss measurement could be carried out with the help of an A.C. Signal obtained from Capacitor Divider, mounted on the roof. This is passed through a Voltage Isolator before being conditioned to give no output when a signal is present. Whenever a loss of contact occurs, the conditioning circuit produces an output in pulse form, length of which is proportional to the distance over which contact is lost. The event should also be signaled by an Audible Alarm in the Instrument Room.

Any other method, which is more accurate and suitable to measure at higher speed of OHE Recording Car, may be offered. If the Tenderer feels that their proposed method is superior to the methods given above, Tenderer have to submit the detailed procedure and justification for acceptance of the Purchaser, Contractors’ design shall have given satisfactory performance for a minimum period of two years on Railway Networks elsewhere.

k) Mast Identification System
The GPS receiver shall identify the location of OHE masts co-relating with measured data. Geographical positioning system shall be utilized for the mast identification along the track. The GPS/optical mapped data is in text file and shall be required to be correlated with the software of measuring instrument system so that the location of the measured data is automatically displayed/printed along with the event recorded. Accordingly, chart recorder/report output shall indicate the exact location of recorded event, giving the mast number. Alternatively optical identification system can also be employed to detect the Catenary Wire support (Mast) along the track continuously. The Optical Mast Identification system shall be active where GPS is not visible such as through tunnels and other critical locations. GPS data shall be transferable to PC/Laptop using suitable software and accessories. The GPS data shall be provided by the Railways. Antenna of sufficient cable length shall also be provided. The accuracy required for mast location shall be minimum + 4 meter.
Any other method, which is more accurate and suitable to measure at higher speed of OHE Recording Car, may be offered. If the Tenderer feels that their proposed method is superior to the methods given above, Tenderer have to submit the detailed procedure and justification for acceptance of the purchaser. Contractors’ design shall have earlier given satisfactory performance for a minimum period of two years on railway networks elsewhere.

3.3 RECORDING AND PRESENTATION OF TEST RESULTS:

3.3.1 All processed results shall be presented with reference to the specific mast location on the track and kilometerage. It should be possible to initialize the reference kilometers by the operator at any stage. All distance measurements after initializing the kilometer shall be with reference to kilometer so entered till the next initializing by operator.

3.3.2 The exact format for presentation of reports over computer monitor and plotter/printer shall be mutually decided after award of the tender. Such presentation may take the form of continuous display correlated with the mast location and recorded parameters and kilometric progressive over a suitable scale or may take the form of reports generated on the basis of exceedence of certain threshold values. The processing software shall take care of the requirement of IR gauge and OHE for the purpose.

3.3.3 Quality of current collection

During the run the number of times the contact has been lost between OHE and pantograph and the duration of such loss shall be recorded. Computation shall be done for:

(a) Number of time contact lost between OHE and pantograph in a kilometer of track traversed by the loco.
(b) Total duration of contact interruption between OHE and pantograph expressed as percentage of total duration of test run (or measuring time) in the particular section,
(c) All the above measurements/computation, contact/ interruptions shall be grouped into five categories, namely

- i) Interruptions having a duration between 2.5 to 5 ms
- ii) ---------------- do ------------ 5 to 10 ms
- iii) ---------------- do -----------10 to 15 ms
- iv) --------------do ---------------- 15 to 30 ms
- v) ---------------- do ------------ more than 30 ms

3.3.4 The contact force values shall be grouped into the following six categories for processing or presentation with reference to any of the parameters being sensed:

- 0 kgf – 4 kgf
4.1 kgf – 8 kgf
8.1 kgf – 12 kgf
12.1 kgf – 16 kgf
16.1 kgf – 20 kgf, and Greater than 20 kgf.

3.3.5 Recording facilities

i All parameters shall be recorded and archived on a suitable multi-channel recorder. The storage space shall be adequate for storing information for a cumulative run of 10,000 kms or 90 days whichever is less.

ii All measured and recorded data shall be converted from analogue to digital form: classified, analysed and stored on an On-Board microprocessor based data acquisition, and analyzer system. It should be possible to generate suitable reports involving simple logic from the database.

iii It shall be possible to print out all or any of the parameters in juxtaposition as a function of distance or mast location without any classification, if desired. Normally the data shall be required to be printed after classification and analysis as specified.

For example in a test run of 10 minutes covering 25 km., the information may be required in the following format:

(a) No. of contact losses of 2.5 ms – 4.5 ms
(b) Location of every individual incident with reference to the nearest mast.
(c) Total loss of contact expressed as a percentage of total test time
(d) Incidents and their duration of contact forces falling below 7kg.

3.3.6 Suitable recorder is to be provided for recording all parameters in juxtaposition for off-line processing. The resolution of the parameters recorded shall be commensurate with the variation of the recorded value.

3.4 EMI REQUIREMENTS

3.4.1 The OHE Recording Car shall be working under 25 kV, 50 Hz, OHE system. Electronic signals generated inside the measuring equipments, inverters and vehicle control systems shall not be affected by this and OHE Recording Car with all instrumentations shall work without any adverse performance.

3.4.2 The tracks over which the offered system will work may be equipped with DC track circuits, 83-1/3 Hz track circuits as well as track circuits at higher frequencies. Harmonics generated by the measuring equipments should not affect signaling gears like audio frequency track circuits and axle counters which work in the range 0-5 kHz with a limit of 400 mA. On the
Communication network, control circuits, tele-printer circuits, as well as VHF/UHF and microwave circuits are employed. The Psophometric voltage induced on communication circuit running by the side of track should not exceed 1 mV.

3.4.3 The electric and electronic equipment used in the inverters and Vehicle Control System shall comply emission and immunity aspects of EMC to CENELEC standard EN-50121-3-2. The internal EMC shall cover a combination of earthing, shielding and isolation of interference sources so that conducted and radiated noises are properly segregated or suppressed and no other equipment is affected due to operation of measuring equipment. The following interference current in the output current waveform shall not be exceeded at any point in the operating envelope of the OHE Recording Car:

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Current Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Hz</td>
<td>400 mA</td>
</tr>
<tr>
<td>1700 ± 50 Hz</td>
<td>300 mA</td>
</tr>
<tr>
<td>2000 ± 50 Hz</td>
<td>300 mA</td>
</tr>
<tr>
<td>2300 ± 50 Hz</td>
<td>300 mA</td>
</tr>
<tr>
<td>2600 ± 50 Hz</td>
<td>300 mA</td>
</tr>
<tr>
<td>5101 ± 50 Hz</td>
<td>100 mA</td>
</tr>
</tbody>
</table>

3.4.4 Emission from OHE Recording Car to outside world shall be limited to level specified under CENELEC standard 50121-2. The tenderer shall submit the simulated values of these interference currents in their offer.

3.5 Inspection and Testing of measuring instruments.

3.5.1 Successful tenderer shall arrange all facilities to conduct performance tests of the measuring instruments as per the required features of the instrument.

3.5.2 Tenderer shall give complete details of tests schedule for conducting tests to assess the capability of all measuring equipments. The test shall preferably be conducted in 25 kV a.c. traction or similar environment to establish compliance of the measuring capability of OHE parameters.

3.5.3 The tests related to design & other physical parameters shall be witnessed by the authorised representative of purchaser at suppliers premises.
**Chapter-4**

DETAILED OF OHE RECORDING CAR

### 4.1 TECHNICAL REQUIREMENTS

<table>
<thead>
<tr>
<th>Para</th>
<th>Subject</th>
<th>Item</th>
<th>Technical specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General</td>
<td></td>
<td>The OHE Recording Car shall have diesel electric/Diesel Hydraulic transmission. The general design of the OHE Recording Car shall be as per standard industry practices, and fit for the purpose. It shall be manufactured with adequate running stability and suitable for use on Indian Railways. All standard materials shall be used to manufacture the OHE Recording Car that it is acceptable to the buyer. The OHE Recording Car shall be manufactured so that it can be used for working under all weather conditions in India.</td>
</tr>
</tbody>
</table>
| 2    | Purpose of use (applications) | | 1) The OHE Recording car shall be equipped for measuring and recording OHE parameters such as -  
   1. Stagger of contact wire  
   2. Height of contact wire  
   3. Thickness of contact wire  
   4. Gradient of the contact wire.  
   5. Setting Distance.  
   6. Contact Force.  
   7. Pantograph acceleration etc.  
   All measured data shall be made available on the On-Board microprocessor based data acquisition and analyser system. It shall be possible to generate suitable reports and print them on a printer provided in instrument room on the car. The tenderer shall submit a detailed scheme along with the measuring equipment with offer |
| 3.   | Vehicle Parameter | Dimensions | As per Indian railways Schedule of Dimensions 1676 mm Gauge (BG), Revised 2004 (with latest revision) |
|      |                     | Vehicle Type | 8 -wheeler with two bogie |
|      |                     | Maximum Speed | i) 110 km/h under its own power.  
   ii) 150 km/h when coupled to a train. |
<p>|      |                     | Diesel Engine | • Fuel efficient Diesel Engine of suitable capacity with all accessories including |</p>
<table>
<thead>
<tr>
<th>Safety Devices from Reputed Manufacturer (Design Details to be Submitted with the Offer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhaust emission shall be below the limit laid down in UIC/ORE No. B13/RP22/E Clause 4.</td>
</tr>
<tr>
<td>The total engine power shall be adequate to start and haul the OHE Recording Car at 1 in 60 up gradients.</td>
</tr>
<tr>
<td>Tenderer shall furnish the OHE Recording Car performance characteristic and calculations.</td>
</tr>
<tr>
<td>The fuel and lubricating oil consumption in liters/Hours at 75% of the rated output of the diesel engine shall be submitted.</td>
</tr>
<tr>
<td>Other details given in para 4.2 below.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transmission System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel Electric/Diesel Hydraulic system. The driving mechanism shall be rugged and efficient to perform satisfactorily during operation and run. Details of the transmission system along with equipment/fittings shall be submitted with the offer.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coupling and Buffer Arrangement.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centre Buffer Transition with screw coupling conforming RDSO's Specification No. 56-BD 07 along with the side buffer arrangement to RDSO's Drawing Number SK-98145.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Axle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conforming to RDSO's Drawing No. IRS R-43/92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum Axle Load.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.32 Tonne (The maximum axle load shall not exceed 20.32 tonne in any case and preferably shall be as less as possible)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wheels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conforming to RDSO’s Drawing No. IRS R-19/93</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wheel Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conforming to RDSO drawing No SK-91146</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wheel Base and Wheel Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>As per Chapter IV-(A) of Indian railways Schedule of Dimensions 1676 mm Gauge (BG), Revised 2004 (with latest revision)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frame, Frame Components and Bogie</th>
</tr>
</thead>
<tbody>
<tr>
<td>As per standards of the manufacturer suitable for mentioned applications (design details to be submitted along with the offer)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td><strong>Brake system</strong></td>
</tr>
<tr>
<td><strong>Parking Brake</strong></td>
</tr>
<tr>
<td><strong>Central control console, Manual backup</strong></td>
</tr>
<tr>
<td><strong>Batteries</strong></td>
</tr>
<tr>
<td><strong>Pantograph</strong></td>
</tr>
<tr>
<td><strong>Pneumatic Auxiliaries</strong></td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>---</td>
</tr>
</tbody>
</table>
| **Auxiliaries** |   | applicable IEC standard.  
• The electrical wires shall be oil and fire resistant.  
• All electrical and electronic components shall be at least IP-67 protected and with requirement suitable for the climate prevailing in India (Para 4.4)  
• All control system shall be preferably 110 V DC |
| **SAND BOX** |   | i) Four sand boxes of approximate 25 liters with water tight cover shall be provided  
ii) Four ejectors actuated by electro-distributors, controlled by means of push-buttons from the control panel in the cab. |
| **Warning/Sign Boards** | The warning/ sign boards, as applicable shall be provided. Details shall be submitted with the offer. |
| **Vehicle rail use regulations** | Maximum Moving Dimensions | The machine shall not infringe the Maximum Moving Dimensions, as per Diagram 1-D of Indian railways Schedule of Dimensions 1676 mm Gauge (BG), Revised 2004 (with latest revision) |
| **Safety Feature** |   | • Standard VCD of approved make.  
• Emergency stop switches  
• Horn  
• Flasher Units  
• Marker light  
• Twin Beam Head lights  
• Speed Recorder  
• Emergency brake valves  
• Parking brake  
• Electrically operated wipers  
• Fire extinguishers |
| **Other features** | The following features shall be supplied in the vehicle:  
• First Aid Kit  
• Working lights - Flood lights, Orientable Search light. Detachable search light.  
• Cordless Public Address System.  
• Close circuit TV(LED) screen with video Camera.  
• Standard Mobile charging socket.  
• Lockable Tool Box |
13. Specifications/ Standards

A list of standards and specifications for manufacturing, testing and commissioning of various equipment shall be submitted along with offer.

14. Testing

**Type tests**

- Oscillation Trial-The Riding Quality Test shall be conducted at a speed which is 10% higher than the maximum specified operating speed. The test shall be conducted as per RDSO’s conventional DAS method as mentioned in RDSO Document No. MT-334.
- Emergency Breaking Distance (EBD) and Haulage Capacity Test shall be conducted.
- Squeeze Load Test shall be carried out as per standards.

Details of proposed Factory Acceptance Tests (FAT) protocol to be submitted for approval. This should include:
- Verification of dimensions of vehicle, assemblies, attachments
- Verification of submitted performance particulars of vehicle, assemblies, attachments
- Verification of safety features

**Weighment**

The Car shall be weighed as per standards.

4.2 Diesel Engine

4.2.1 The OHE Recording Car shall be powered by suitable capacity of proven make Cummins or equivalent or better, fuel efficient diesel engine capable of fulfilling the requirement of specification.

4.2.2 The diesel engine shall work satisfactorily with fuel oil to Indian Standard Specification No. 1460 (2005)

4.2.3 Filters for engine air intake shall be provided with restriction indicator to ensure satisfactory performance under dusty environment.

4.2.4 The tenderer shall submit notch wise Engine rpm and power.

4.2.5 The tenderer shall be responsible for ensuring proper alignment of engine and transmission.
4.2.6 Air intake with filters, ducts and exhaust arrangement shall be compatible with engine system.

4.2.7 The exhaust and silencer arrangement of power equipment shall be properly routed for emission.

4.2.8 The fuel tanks of adequate capacity shall be provided.

4.2.9 The tenderer shall clearly spell out the emission standards of the engine being offered.

4.2.10 The engine will be equipped with **standard** eliminator filtration system for engine oil filtration. This eliminator filter is a combination of self cleaning filter and disc stack centrifuge housed in a single unit which is engine mounted. This eliminator system is required to give benefits like filter service at engine overhaul, centrifuge service at 2000 hours for centrifuge, completely sealed full flow system to reduce possible contamination with high burst pressure and continuous & automatic back-flushing system via filtered oil without assistance of external power source.

This eliminator system is intended to increase productivity by providing benefit of reduced filter services / maintenance cost and time, eliminate full flow filters and bypass disposable filters and its associated hoses and mounting parts.

4.3 Cooling System

4.3.1 The cooling equipment shall be guaranteed to work efficiently under climatic conditions specified in chapter-II. Apart from meeting the requirement of Diesel engine including after cooler, the cooling equipment shall be required to dissipate heat of lube oil, hydraulic oil used for hydrostatic fans with 30% chocked condition of radiator used. Airflow required for the radiator fan shall be at least 15% more than actually required to make up for any reduction in airflow due to train movement. The limiting ambient capability of the cooling system should be minimum 55 °C with 30% chocked condition.

4.3.2 The initial fill of hydraulic oil for hydrostatic operation of fans in the cooling system as recommended by the manufacturer shall be in the scope of supply.

4.3.3 Side mounted radiator and hydraulically driven fan assembly; with side panels shall be provided. For ventilation of engine room, hydraulically driven fan of adequate capacity shall be provided. The hydraulic pumps and motors used for cooling will be of fixed displacement types.

4.3.4 **Roof mounted radiator** with Hydraulic hoses of proven make with adequate factor of safety shall be used for cooling system. The hoses shall be properly routed and secured so that it does not fail due to vibration or infringement.
4.3.5 Water level indicator shall be provided on radiator tank and it should be easily visible and readable.

4.3.6 During operation at maximum output, the radiator fan and ventilation fan shall not be source for noise and vibration.

4.3.7 The tenderer shall submit following details and calculations for the offered cooling system:
- Cooling requirement for all sources of heat (with break up)
- Heat dissipation characteristics of the radiator and its resistance characteristics.
- Radiator fan characteristics showing the air flow Vs total heat at different speeds.
- Cooling system-matching calculations.
- Schematic cooling circuit diagram showing water, oil and airflow.
- Installation drawing of radiator, fan assembly for both cooling and ventilation arrangement shall be provided.
- Cooling proving trial including testing of hydraulic oil cooler, shall be conducted at contractor’s premises to prove adequacy of the offered cooling system for prototype in presence of authorised representatives of purchaser. The maximum temperature of hydraulic oil shall not exceed 70 °C.

4.3.8 The hydraulic oil tank shall be of stainless steel. It shall be provided with oil level indicator, temperature indicator, oil level switch and oil filter with restriction indicator. A micro/limit switch shall be provided and interlocked with delivery side shut-off valve.

4.4 Power Transmission System

4.4.1 The OHE Recording Car shall be powered by CIL make or equivalent or better proven make fuel efficient diesel engine capable of producing adequate power output to meet operating and service condition mentioned in Chapter-2. The engine shall be adjusted to deliver suitable power to the alternator under site conditions.

4.4.2 All electrical equipment shall comply with relevant latest IEC/AAR/IEEE Standards. Tropical humid weather conditions prevailing in India shall be kept in view in the design of all electrical components.

4.5 CONTROLS AND GAUGES

4.5.1 Adequate control equipment including gauges, instruments and cab safety devices shall be provided for safe and satisfactory operation of the car. All gauges shall be of proven and reliable design. Graduations of all gauges shall be in metric units. Following gauges shall be provided in the cab: -
- Local engine starting switch/push button
- Battery charging/discharging ammeter
- Local engine stop switch/push button
- RPM meter
- Diesel engine lube oil pressure gauge.
- Cooling water temperature gauge (Electronic).
- Fuel oil pressure gauge.
- Air brake gauges.
- Battery charge and discharge ammeter.
- Water level indicator (Electronic)
- Speed indicator cum recorder.

The following audio-visual signals or reference panel lights shall be provided in the cab for single and multiple operation of the Power cars:

- Low lubricating oil pressure.
- Radiator water temperature too high.
- Cranking contactor welding indication
- Traction control supply ON
- Rectifier fuse failure
- Rectifier cooling fan failure
- Aux. alternator failure
- Parking brake applied
- Drive function released
- Common annunciation

The following safety devices, inter alias, shall be provided:

- Water temperature too high - Transmission cut-off and engine will return to idle.
- Low water in radiator - Power to transmission cut-off and engine shut down.
- Low lube oil pressure - Power to transmission cut-off and engine shut down
- Engine speed too high (Over speed trip) - Power to transmission cut-off and engine to shut down.

Adequate protection of an approved design shall be provided against electrical overloads and grounding.

4.6 SPEED INDICATOR / RECORDER

Speed indicating and recording equipment of 0–160 kmph range, shall consist of an axle box mounted opto-electronic speed sensor, one junction box and one recorder cum indicator unit with micro controller containing FLASH EEPROM internal memory for calculating and recording the journey data. A portable FLASH memory card shall be used for external memory.
MECHANICAL REQUIREMENTS

5.1 OHE RECORDING CAR BODY

5.1.1 The OHE Recording Car body and attached equipment shall be designed to provide for adequate clearance between car body and bogies for worst case operating conditions.

5.1.2 The structure of the OHE Recording Car body including shell shall be suitable for severe testing and recording of OHE parameters services and have a design life of at least 35 years in the services under 200% overload conditions with no fatigue or permanent deformation failure.

5.1.3 Cabs of both ends of the OHE Recording Car shall have streamlined design to give an aesthetically pleasant appearance. Use of fibre molded sheets or any other similar material for the purpose of giving modern aesthetic design shall be avoided as far as possible.

5.1.4 The body shell shall be of integral lightweight construction consisting of separate assembly groups for under frame, sidewalls, roof and end walls, joined together to form a tubular structure. These assembly groups shall be made from the rolled sections or pressed plates and plain sheets, which are suitable for welding. The car body shall be made by spot / resistance welding as suitable and internationally acceptable welding procedure for austenitic stainless steel to be used in the manufacture of car. The car body structure shall be designed to make effective use of metal in providing the required strength and stiffness. Portions of the roof, side frame, and under-frame shall be designed to form a girder to carry the longitudinal and vertical shear, and bending loads resulting from the specified vertical loads. In selecting the type and thickness of material to be used, the Supplier’s design shall optimize strength, durability, and weight.

5.1.5 The OHE Recording Car structure shall be designed so as to withstand the load specified for the material used in accordance with International specification.

5.1.6 Body Bolster: These may be fabricated from pressed sections and shall have suitable pads on which lifting slings may be placed. The material of body bolster should be decided by manufacturer based upon design and strength considerations.

5.2. MATERIALS

5.2.1 All materials used in the construction of the coach shall be of the specified quality and shall comply with the most recent issue of the relevant international standard specification.
5.2.2 The Supplier shall submit to the RDSO, a list showing the names of the suppliers of components, equipment and sub assemblies from whom they propose to obtain the materials and fittings for work under the Contract.

5.2.3 All castings shall be true to dimensions, homogeneous and free from defects and have their mating surface smooth and true to shape. Castings shall be properly annealed and subjected to radiography tests where required.

5.2.4 The use of aluminum and brass fittings for furnishing should be limited to the minimum extent in order to reduce pilferage. Specific approval shall be taken before using such material. Use of Aluminum in the under floor or in the load bearing areas shall not be desirable.

5.2.5 The material used shall be subject to the Supplier’s corresponding QA procedures. It shall be ensured that material of the requisite quality is used throughout the execution of the work.

5.2.6 All the materials to be used for interiors, paneling, furnishing, lighting, ventilation etc. must comply with requirement for fire prevention, protection of passengers in case of fire and from fire-side effect according to international standards.

5.2.7 At the same time no materials are permitted within passenger compartments, which contain asbestos, toxic material or that may splinter or will create sharp edges when broken.

5.2.8 The type and make of the equipment once finalized during design stage shall not be permitted to be changed during the contract unless agreed by the purchaser and RDSO in writing in view of reliability and availability.

5.2.9 The Car body structure, including sheathing shall be constructed of lightweight, high tensile austenitic stainless steel. All stainless structure shall be AISI 301LN (low carbon, with nitrogen) or SUS301L (with Nitrogen) or better with a brush finish. Stainless steel sheathing on the sidewall shall be flat while the stainless steel sheathing on the roof may be flat or corrugated. In case corrugations are provided on the roof, the depth shall not be greater than 1/2 inch (12.7 mm). The corrugations shall not trap moisture. Underframe members shall be of corrosion resistant structural steel to IRS M-41 with body bolster to copper bearing quality steel to IS: 2062 Fe 410 Cu WC, of welded integral structure.

5.2.10 The selection of stainless steel shall ensure that there are no inter granular corrosion cracking and stress corrosion cracking. Bidder shall confirm this with complete manufacturing and welding procedure/standards adopted and proof of its sustained successful working under loaded conditions as specified.
5.2.11 The weight of the OHE Recording Car shall be kept as low as possible consistent with adequate strength to meet the loading without exceeding stresses and deflections specified values for the structure.

5.3 CONSTRUCTION

5.3.1 The manufacturer shall ensure inter-changeability of components and uniformity of structure throughout the fleet for the purpose, a sufficient number of jigs, fixtures, and templates shall be used. Such parts of the bodies as underframe, side frames, end frames, and roofs shall be built on jigs. Interchangeability of all equipments, hangers on all cars without the use of shims or elongated holes shall be ensured.

5.3.2 Adequate drainage shall be provided in all body-structure members, and elsewhere as necessary to preclude water entrapment. Enclosed structural cavities shall be vented to prevent accumulation of condensate. In areas where water might be ingested, corrosion-resistant drain pans and drain lines shall be provided and shall be arranged to divert the discharge clear of all equipment and structure. Means shall be provided to prevent clogging of drain lines and drain holes. Any enclosed structural cavities of the steel members shall be treated with a rust-inhibiting coating. Interior floor should be capable of being washed with hose pipe. There should be no location where water may stagnate.

5.4 SURFACE FINISH AND FLATNESS

5.4.1 All exterior non-corrugated surfaces shall be free of ripples and buckling. The surfaces of flanges and webs of all structural members shall be straight and flat, and free of ripples, buckling, dents, gashes and other surface imperfections.

5.5 REQUIREMENTS FOR STRENGTH OF OHE RECORDING CAR BODY

5.5.1 The mechanical strength of the OHE Recording Car body structure shall comply with the requirements of UIC 566.

5.5.2 The Car body, and any equipment mounted on, beneath or within it shall be designed to withstand the fatigue loads that the car body structure will encounter in service during its design life. The fatigue life assessment of body structure shall be carried out using proven standard techniques and shall be submitted by the car manufacturer for review by the IR’s representative.

5.6 JACKING PADS

5.6.1 There shall be a minimum of two jack pads on each side sill to facilitate safe lifting of the Car. One set of jack pads shall be suitably located to permit jacking the car with IR standard floor jacks so that the bogie can be rolled
from under the car without removing any equipment or structure. The bottom of all jack pads shall have a non-skid surface to provide frictional resistance against incidental horizontal loading between the jack pad and jack head.

5.6.2 Suitable car jacking pads should also be provided at the front end for lifting the car with the bogie in case of re-railment.

5.7 CORROSION PROTECTION

The exterior of the OHE Recording Car body shall not be painted. Measures that will maintain the original appearance of the car exterior from undue deterioration, staining or streaking shall be adopted. The supplier may indicate appropriate cleaning chemicals to maintain the appearance of the exterior of the car body. Only colored stickers/bands shall be provided on the exterior. For other areas protection against corrosion and painting of cars shall be as per UIC 842-5.

5.8 ROOF AND FLOOR CONSTRUCTION

5.8.1 Roof Structure: Equipment mounted under the roof suspended from the roof structure shall be bolted to the framing members. The framing members shall reinforce in sub-assembly to accept the equipment load.

5.8.2 The Supplier shall ensure the adequate water drainage from the roof such that no water is discharged into the vicinity of passenger doorways. Rain gutters shall be provided over windows and doors. Roof equipment arrangement design shall not permit accumulation of water at all in standing or running condition.

5.8.3 Floor construction: The floating floor shall be constructed so that all applicable noise, vibration, strength and fire endurance-rating requirement are met. A multiplayer hard wearing, non-slip, fire retardant floor covering having high abrasion resistance, water proof and sealed, resistant to staining and easily cleanable using conventional floor cleaning methods and suitable cleaning agent should be provided. The service life of the floor covering shall be at least 3 years.

5.8.4 The floor construction shall be such that it does not permit water to seep through the floor and cause corrosion to floor / underframe component. Indian Railways experience is that most of the corrosion takes place due to seepage of water through the floor and through the window opening and door opening. The non-skid floor structure shall be designed so as to minimize the life cycle cost of the floor over its designed value.

5.8.5 The openings in the flooring for the passage for pipes and cables shall be constructed as to prevent any seepage of the oil and in addition give
effective protection against the spread of any fire originating beneath the body.

5.8.6 Adequate drain holes for floor water drainage at each doorway, drain pipe at one meter apart in whole area of engine room and floor under the seats and at points where water is likely to accumulate should be provided. Stainless steel drain pipes having top end of bell mouth type fitted with stainless steel mesh should be provided to prevent water from spreading on the underside of the coach structure or dripping on to the running gear.

5.9. VENTILATION

Fans shall be provided liberally throughout the Car at suitable location for ensuring adequate comfort to staff.

5.10 DOORS

5.10.1 OHE Recording Car shall have four body side doors, two in each of cabs. Other doors on sidewalls shall preferably be of sliding type with adequate opening to facilitate the loading/unloading of DG sets.

5.10.2 All door openings shall be true to specified dimensions and perfectly square. The openings shall be tested for size and squareness with templates so that doors open and close freely and when closed shall be reasonably weather proof and dust proof. Single leaf inward opening hinged or sliding doors with locking arrangement shall be provided in driver’s compartment and shall have a clear opening of 920 mm. The door leaves shall slide on roller bearing carriers suspended from top rail and shall work in retaining guides on the doorsills. Each leaf shall have a window opening. Since the tenderer is expected to develop his own layout, location of doors may be decided in the most suitable manner. The door layout of the car shall be got approved by RDSO.

5.10.3 Latches shall be fitted on all doors so as to secure them from inside in the closed position.

5.10.4 Where hinged doors are provided on the side walls, they shall be of inward opening type and will give an opening of 750 mm approx.

Rain water gutters of suitable design over the door way shall be provided.

5.10.5 Door foot steps

Anti slip foot-steps shall be provided at all body side doors. The edges shall be protected with metallic treads. A wearing plate shall be provided on all top footsteps. Any other suitable arrangement can also be considered. Distance between the adjacent foot-steps should approximate be 200 mm.
5.10.6 Door hand holds
Door hand holds of stainless steel tubes or chromium plated steel tube, with malleable cast iron brackets shall be provided on either side of all body side doors and shall be fitted so as to clear the side walls sufficiently to prevent injury to knuckles. Hand holds shall also be within the car profile so that mechanized car washing is not hindered.

5.10.7 The doorsill shall be constructed from or equipped with slip proof profile with excellent wear resistance and drainage effect for rainwater.

5.10.7 Door locks
All doors shall be fitted with reliable locks to be operated from outside and inside. Hasps for external padlocking shall also be provided on all doors opening out of the car.

5.11 Windows

5.11.1 Double sealed glass windows of modular design shall be used in the air conditioned coach. The outer glass shall be laminated and toughened safety glass, which does not fall on breakage. This should be indicated in the layout of the car for approval.

5.11.2 All window openings shall be true to dimensions square and of uniform width. The window opening shall not at any point exceed 2 mm over or under the specified dimensions and shall not be out of square by more than 2 mm.

5.11.3 Two suitable emergency open able windows shall be provided in each side of coach.

5.12 Roof

5.12.1 The roof shall be designed to form a satisfactory chord to the superstructure considered as a girder, and to take a concentrated load of 4 men standing, close together at any point. The structure shall consist generally of two main longitudinal members running from end to end of the car, braced at frequent intervals along their lower flanges, and rigidly connected to the arch bars, and to the grab pillars by rigid transverse members. At partition and semi bulkheads, the sills shall be attached to vertical pillars within or forming part of the partitions or semi-bulk-heads. The construction throughout shall be absolutely watertight and shall permit easy renewal of corroded sheets.

5.12.2 Roof Ventilators
The roof ventilators of a better design shall be provided and they shall not violate the schedule of Dimensions.

5.13 Driving Cabs
i) Two driving cabs shall be provided, one at each end, with complete operating & driving control with dash boards to facilitate operation from
either cab. Driver’s seat shall be on the left side. Adequate leg space shall be provided for the driver when he is seated. The general layout and arrangement of equipment in Driver’s cab shall follow UIC CODEX 651 with respect to dimensions, safety features, furnishing, lighting, ventilation, noise level, field of view, driver’s desk, seats etc. Spot lights shall be provided at suitable locations. The cab shall be ergonomically designed for better view and comfort and also the various panels/equipments meant for Driver shall be so laid that they are easily readable and Driver is not required to move physically for any operation during run.

ii) Foldable cushion sheet shall be provided in each of the driving cabs for 4 persons in addition to the Driver.

iii) All controls, brake handle, hand brake, Dead Man’s device for horn and indication lamps/meters shall be within easy access and view of the Driver.

iv) Both the cabs shall be provided with 6 Inch TFT monitor connected with two portable CCTV camera in both the driving cabs.

v) Two numbers, 110 V sockets for hand signals in each cab.

vi) Head Light, Flasher lights search lights and marker lights at both ends of the cab.

vii) OHE voltage sensing device in both the cabs shall be of non contact type.

viii) Full width single piece Stone proof lookout glass with Sun Screen shall be provided at the end wall of each Driver’s compartment and these shall be glazed, clear, colourless poly-carbonate to the standard.

ix) Provision of wind screen Wiper arm and blade Assembly to be provided as per RDSO Specification no.C-K306 (Rev 01).

5.14 The facilities to be provided in the OHE Recording Car shall be as described briefly in the following Clauses.

5.14.1 Material Cabin
A material cabin shall be provided adjoining one of the driving cabs having adequate space and proper locking arrangement for the storage of costly equipments and fittings. The Cabin shall have two steel almirah (with five shelves) for keeping costly items & essential records.

5.14.2 Air Conditioning Equipment
The Air Conditioners shall be of adequate capacity and energy efficient with 5 Star rating to be provided in Instrument room, conference room, cabins and dome etc. The design calculation shall be submitted to RDSO at design approval stage.
5.14.3 The interior, where the computers and instrumentation system and living accommodation etc. are provided, shall be air conditioned with maximum relative humidity of 40-60% and average dry bulb temperature of 20-250C. However the instrumentation of OHE recording car should be capable of performing satisfactorily up to the following maximum temperatures: metallic surface temperature under Sun: 75° C max. and in shade: 55 °C max. The air conditioning equipments should therefore be capable to perform satisfactorily under such a high metallic surface temperature.

5.14.4 Instrument Room
Instrument Room shall be air conditioned and well furnished to keep on board computers, TV, DVD, Printer & Plotter, UPS and other interface equipments, storage of Hard Copies, Reports and other such requirement. The Technical specifications of all the equipments to be provided in the instrument room shall be furnished to RDSO at design approval stage. Suitable ergonomically designed good quality furniture shall be provided to meet the requirement.

5.14.5 Two computers with latest configuration having adequate memory capable of processing and storing information for a continuous run of at least 10000 kms including necessary peripheral devices inclusive of two laser printers (one standby) for printing of reports shall be provided in the instrument Room. Design/ Specification/ Drawing shall be got approved by purchaser. One of the 02 computers shall be connected in the network and other shall be in Hot standby mode such that in the event of failure of one, other Hot standby computer takes over the processing without loss of any measured data.

5.14.6 Conference Room
Conference Room shall be air conditioned having adequate space to accommodate cushioned sofa with centre table and Latest HD-LED 19 inch TV monitor with 02 USB ports. It shall have well illumination including night lamps, Reading Lamps and 02 mobile/Laptop charging points and one power point. Design/ Specification/ Drawing shall be got approved by purchaser.

5.14.7 Staff Cabins
One air conditioned Cabin with four cushioned Berths and one air conditioned Cabin with two cushioned Berths shall be provided. The Cabins shall have separate entry and have windows on both sides. The Cabins shall preferably be not over the wheels and made sound proof as far as possible.

5.14.8 Lavatory
One Indian style WC with separate over head Tank, Stainless Steel Sink and other accessory fitting and a folding cushioned seat including shower with flexible Hose shall be provided. The WC shall be provided with an exhaust Fan. The lavatory shall be provided with pan as given in coach layout. The flooring in lavatories shall be provided with stainless steel inlay fabricated out
of stainless steel sheet to AISI-304. The Inlay in the lavatory with Indian Style Lavatory shall be covered with single piece vinyl sheet to RDSO schedule of Technical requirement of flexible polyvinyl flooring used in coaching stock. RDSO/2006/CG-12 (latest version with all amendments), all joints shall be hot air welded to avoid seepage of water.

5.14.9 Provision of two Mobile Charging points to be made in Cabins as well as in both the driving cab and working area. In addition two folding berths shall be provided at suitable location without cabin.

5.14.10 Kitchenette
   A kitchenette approximately 1500 mm X 2000 mm shall be provided with exhaust fan on one of the windows. Windows for cross ventilation shall also be provided. Kitchenette shall have provision for keeping cooking range (LPG cylinder, a refrigerator, microwave oven, Cooking utensils and complete dinner set. A detailed list of provision in kitchen shall be submitted along with the offer.

5.14.11 Communicating doors
   Each driving cab shall have independent entry from both sides. The OHE Recording Car lobby shall have entry from both the cab through communication inside the OHE Recording Car shall be provided. It shall be possible to isolate the cabins using sliding doors with locking arrangements.

5.15 Facilities on roof
5.15.1 Two pantographs one of which shall be an AM-12 type and the other direct air raised pantograph for high speed electric. The OHE car manufactured by successful tenderer shall be fitted with both the pantographs. The roof layout and instrumentation fitment shall be so configured that it is possible to view either of the pantographs from the observation dome. Appropriate switching mechanism to allow raising of only one Pantograph at a time shall be provided to preclude the possibility of both Pantographs being lifted up simultaneously.

5.15.2 Complete pneumatic circuit including compressor, d.c. power supply etc. for raising and lowering of pantograph is covered in the scope of work and has to be provided by the tenderer.

5.15.3 For illumination of roof for night inspection four water proof industrial plug points shall be provided for fixing portable lights.

5.15.4 Two pneumatic points for connecting pneumatic operated/driven tools and fasteners shall be provided.

5.16 Observation dome
   An air conditioned observation dome shall be provided in the roof near the pantograph so as to observe interaction between the contact wire of the OHE and the pantograph. The observation dome shall be the part of instrument
room. Two to three persons shall be able to sit comfortably in the observation dome. The upper portion of the dome shall be of polycarbonate/FRP with reinforcement if required for adequate strength and shall also be insulated for 25 kV. The arrangement shall be such that an unobstructed view of the contact between contact wire and pantograph is obtained by the persons in the observation dome without any strain. For this it is essential to have suitable ergonomically design of sitting arrangement. The chair provided in the observation dome shall have adjustable height, back rest with back and front adjustment just like in an automobile Car. (BEML stated that this is not feasible.)

5.17 Suitable safety measures including interlocks between various equipments, access doors and line equipment shall be provided to ensure.

(i) Safety of men and
(ii) Stability of the OHE Recording Car while in operation.

The tenderer shall indicate the proposed interlocking and safety aspects.

5.18 The entire OHE Recording Car including bogies, superstructure alongwith equipment is to be effectively earthed as per standard practice for rolling stock. Schematic and other detailed drawings for earthing shall be got approved by RDSO.

5.19 The equipment fixed to the under frame shall be secured properly by providing extra metallic chains of adequate strength to safeguard the equipment and to perform efficiently.

5.20 Communication System
Communication shall be provided between all the cabins of the car and observation dome. The communication facility in observation dome should be of speak-phone type to enable the personnel to speak without lifting the hand set. At all other places it shall be of handset type.

5.21 Noise Parameters
The OHE Recording Car and measuring equipments shall be so designed and built that specified noise level is not exceeded. The equipment design and their mounting arrangement shall ensure the generation of noise and vibration to bare minimum. The design of the vehicle shall have adequate attenuation of air-borne and structural-borne vibrations along potential paths from the sources to passenger area and to wayside receptors.

5.22 The Contractor may propose car exterior and interior noise level standards better than those specified herein provided that this does not cause significant weight penalties.

5.23 Interior Noise Level
5.23.1 Interior noise criteria apply to measurement within an empty and stationary car with doors and windows closed.

5.23.2 Propulsion equipment noise in the passenger area: The noise level shall be measured at any point along the longitudinal centerline of the OHE Recording Car and at a height of 1200 mm above the floor level.

5.23.3 Auxiliary Equipment Noise with Car Stationary
With all auxiliary equipment operating simultaneously at maximum capacity, the noise level in the car shall not exceed 70 dB (A) at any point along the car centre-line 1600 mm above the floor and not less than 600 mm from the end of the vehicle.

5.23.4 Noise level in Driver’s cab
The general layout and arrangement of equipment in drivers cab shall follow UIC CODE 651 OR (latest edition) with respect to dimensions, safety features, furnishing, lighting, ventilation, noise level, field of view, drivers desk and seats. Spotlight shall be provided at suitable locations.

5.24 Exterior Noise Levels
The exterior noise levels, as measured on dry track shall conform to the values as under. During the tests all windows and doors shall be closed and all propulsion and auxiliary equipment shall be running at maximum levels.

5.25 Train Stationary
With OHE Recording Car stationary and all systems operating simultaneously under normal conditions, the noise level measured at a location 15m horizontally from the track centerline on a horizontal plane passing through the axle centerlines shall not exceed 65 dB (A) at any point along the length of the vehicle on either side.

5.26 Train Moving With OHE Recording Car moving on grade with clean smooth rails at all speeds from 0 to 105 km/hr and whilst accelerating or braking with all vehicle systems operating simultaneously under normal conditions, the noise level measured on either side, at 25 m from track centerline on a horizontal plane passing through the axle centerlines, shall not exceed 80 dB (A).

5.27 Fire Performance

5.27.1 The OHE Recording Car stock shall be designed to minimize the risk of a fire starting and to prevent the fire propagation through the use of fire barriers in the floor and in walls at the sides and ends and fire resistant equipment housings. Flammable materials shall be well contained and protected.

5.27.2 All non-metallic and furnishing materials such as artificial leather seat covering, flooring material, vestibule material, GFRP paneling, cushioning material etc. shall satisfy the requirements of resistance to spread of flame and deterioration in visibility due to smoke etc. as per UIC 564-2 OR Class A
or superior International standard.

5.27.3 A reliable automatic fire/smoke detection system shall also be provided on the car. The system should not cause any discomfort or undue alarm to the travelling public. The design of the system shall be got approved by purchaser.

5.27.4 Fire prevention in OHE Recording Car shall be suitably provided as per latest UIC standard/RDSO’s Specification No. RDSO/PE/CP/EMU/0001 Rev.0 of Aug.’2003 (Amendment No.1 of July’2006) and with latest revision.

5.28 Interior Finish & Furnishing

5.28.1 The contractor shall propose world-class vehicle interiors, which incorporate a modern aesthetic approach with considerations to optimize staff comfort, safety and security as well as to minimize noise in the Car. The interior configuration shall be based on modular concept where the end areas of the vehicle are as like as possible.

5.28.2 All interior surfaces must be finished with good blending and good slow ageing properties to provide a pleasant, high quality interior and for ease of cleaning and maintenance. Provisions shall be made to prevent any squeaking, rattling or drumming. Items such as rubber strips and other items shall be integrated with panels as far as possible.

5.28.3 All interior panels shall be of glass fibre reinforced panels GFRP. All internal GFRP surfaces shall have solid surface top (paint less) and be smooth finished. The panels shall be resistant to water and aggressive cleaning chemicals for graffiti removal, high temperatures, UV-light and radiant heat. The panels shall be resistant against kicks, punches and scratching. No cracks shall occur. Areas around fasteners shall specially be considered. Exposed materials and surfaces shall withstand daily use of various cleaning agents (alkaline or acid detergents, petroleum solvents and mechanical action of brushes) without loosing colour or noticeable deterioration of surface. The panel should have a durability of at least 10 years without blistering, scratch, dent, crack, discoulour, lose their gloss level or any form of colour deterioration.

5.28.4 The interiors should not have visible screws/ allen screws. The fastening devices, fixings and securing screws shall not be visible from within the cars. All the interior fittings shall have anti injury features should not have sharp and pointed edges. Rounded corners or covings shall be provided wherever mutually perpendicular flat plane surfaces abut. Metal kicking strips with radiused transitions must be provided in the interiors of the car body such that no moisture can penetrate.

5.28.5 Gaps between all interior-lining panels, seat, shell etc. shall be minimized. The effects of the thermal expansion shall be taken into account and all
unsealed gaps shall not exceed 1mm in depth where feasible. Suitable cushioning at panel joints shall be provided to suppress noise. All the joints of interior panels and flooring shall be so sealed that there are no cavities or spaces where insects such as cockroaches etc. can hide and breed.

5.28.6 Materials used shall comply with the relevant UIC specifications. Where UIC specifications do not exist, the contractor shall submit relevant specification for proposed material for approval. The contractor shall submit the test procedure of proposed material for approval. Materials and substances classified as prohibited and restricted shall not be used.

5.28.7 The berth covering should be stain resistant, easily cleanable, fire retardant material in pleasing colour and pattern. The cushioning material should also be fire retardant. Material should be in use in passenger cars in UIC railways. The berth covering should give a service life of at least six years.

5.28.8 Equipment cupboard for housing equipment, for which access from the Car is necessary, may be provided at the car body ends.

5.28.9 The car manufacturer before undertaking manufacture should make 3-D model drawings on Unigraphics, CAD software version NX 4 and submit them for approval of the interior-furnishing scheme.

5.28.10 After approval of 3-D model drawings, mock-up of vehicle with interior furnishing shall be prepared and got approved by RDSO by the manufacturer before taking up manufacturing.

5.29 Exterior and Interior Colour Scheme
Exterior and interior colour scheme of OHE Recording Car shall be got approved by RDSO.

5.30 Cattle Guard
Cattle guard shall be provided at the driving ends of each unit. The cattle guard shall have enough strength so as not to collapse on line in case of collision with stray animals like cows etc. In any case, damage to the system shall be minimal and it shall be ensured that the train service is not adversely affected.

5.31 Piping and Pipe Fittings

5.31.1 Seamless stainless steel pipe bright annealed to ASTM A 269, Gr.304, which can be bent cold, shall be used. The layout of piping shall be designed to keep all pipes, especially the brake cylinder pipes, as short and straight as possible. Bends should be used throughout, but where elbows have to be used, they shall be of round type. Where the pipes themselves are bent, their internal area shall be maintained uniformly.
5.31.2 Double ferrule pipe fitting consisting of body, front ferrule, back ferrule and nut shall be provided. The body and nut will be of carbon steel to ASTM A-108 Grade II with electro cobalt zinc plating with chromic passivation. The front ferrule and back ferrule will be made from Stainless Steel to ASTM A 276 TP 316 SS and conforming to ICF specification no. to be as per ICF/MD/SPEC-166 with latest amendments.

5.31.3 All pipes shall be adequately clamped to the frame assembly with proper clamps.

5.31.4 Flexible hose connections conforming to spec. SAE 100R1 only shall be used.

5.32 Elastomers
All elastomeric parts shall be of neoprene, unless otherwise required. The elastomer shall be compounded and cured to perform satisfactorily in the temperature range specified in this specification. The elastomers shall have high resistance to ultraviolet radiation, weather, washing fluids used by IR, salt deposits and the longest possible life consistent with the other characteristics specified. All elastomeric parts shall be resistant to Ozone, oxidation, heat, oil, grease, salts and acids. The resilient mounts shall be of natural rubber. Synthetic rubber compounds may be substituted for natural rubber only when approved for a specific application.
6.1 Illumination:
Driving cabs, staff cabins, observation dome and instrument room etc. shall be provided with adequate level of illumination at the working plan level (1m above the floor level).

6.2 ALTERNATORS

6.2.1 Engine mounted auxiliary alternator of adequate capacity with rectifier for the speed range between idle and maximum of engine speed shall be provided on each engine to supply 24 V d.c. for charging the battery provided for engine starting.

6.2.1 Engine driven Auxiliary Alternators with rectifier and voltage regulator of adequate capacity shall be provided. The drive for the alternator shall be taken from auxiliary end of engine. The auxiliary alternators shall cater to the following electric loads:

1. Two twin beam head lights, one at each end.
2. LED Flasher Light and LED marker light
3. 110 V supply for controls and cab equipments
4. Charging of 110 V, 120 Ah batteries
5. Light & Fan load of OHE recording car.

6.2.2 Axle Driven Alternator
Apart from engine driven auxiliary alternators, one axle driven alternator of 4.5kW capacity shall be provided to cater the above loads in case the OHE recording car is running idle or attached to a train. A change over switch may be provided at a convenient location before the rectifier-regulator panel. An interlock shall be provided so that at a time, either engine driven or axle driven auxiliary alternator is functional. (BEML’s Comments: Since the traction Motors are mounted on the axles, space for mounting of axle driven alternator not available.)

6.3 Rectifier–Regulator
6.3.1 The rectifier –regulating equipment shall be under frame mounted and confirming to IEC-60571. Crimping sockets required for inter-connecting and output cables shall be supplied along with the equipment.

6.3.2 The rectifier regulator box shall have an openable front cover, which shall be capable of being closed and locked in position by a suitable hinged bolts and nuts. It shall have protection level of IP 55 (hose proof) and shall be electro-galvanised and painted grey.
6.3.3 The regulator shall have provision of potentiometers for currents and voltage setting for adjustment depending upon the service conditions.

6.4 BATTERY

6.4.1 Starter Battery
24 V, 450 Ah, low maintenance Lead Acid storage batteries (5 hrs. discharge rate) of approved make shall be provided. Adequate fuse protection is given in positive and negative battery circuit. The battery shall cater to 3 cranking of engine at 10 seconds' interval.

6.4.2 Battery for controls
110 V, 120 Ah, VRLA type batteries of approved make, conforming to RDSO/PE/SPEC/TI/0009-1999 with latest amendment, shall be provided for controls & lighting which cater to all auxiliary electrical load of the OHE Recording Car for two hours and only lighting and fan load for five hours in case of auxiliary alternator failure.

6.4.3 Terminals/sockets for charging the batteries from external charging equipment shall also be provided. The location of the batteries shall be such that there is no danger of getting damaged due to tools and equipment inadvertently falling on them and battery fuse. If the cells are packed in two rows in the battery box, a hylam sheet shall separate the two rows. The battery shall be charged by the engine driven alternator/rectifier.

6.5 Power supply arrangement to air conditioning & other loads
The successful tenderer shall provide two DG sets (noise-free) preferably under-slung type of adequate capacity each, which shall generate 415 V, a.c., 50Hz. 3-phase power supply for air-conditioning, lights and fans, computers, chart recorders, printer, measuring equipments, UPS etc. The successful tenderer will have to provide a dual UPS (un-interrupted power supply) system including maintenance-free battery so that in the event of the failure of supply from diesel alternator set, during the run, the measurements, data processing, recording and display systems are not affected for at least 2 hrs and a skeleton light/fan service is also available. A suitable auto changeover switch between two DG sets shall be provided. Tenderer shall furnish the design calculation of DG set capacity for meeting the requirement of electrical load of the OHE Recording Car. (BEML’s Comments: Provision of two DG sets under slung not feasible due to space constraint. The same will be mounted on board.)

6.6 CABLES & OTHER ELECTRICAL FITTINGS
Electron Beam Irradiated Power & control cables of standard metric sizes shall be provided as per RDSO Specification No. ELRS/SPEC/ELC/0019 (Latest). Terminal ends for control cables and wire shall conform to RDSO Specification No.MP- 0.5200.04.
6.7 Circuitry
The load shall be suitably distributed based on standard practice. Separate wiring circuits for 110V DC & 240V AC power supply shall be provided to cater the segregated lightning & fan loads for better reliability and availability of power supply in the OHE car.

6.8 Power for head lights, tail lights & other safety lights

6.8.1 Headlights, tail lights, flasher lights, marker lights, dash board lights and driver’s cab lights shall be supplied from the alternator/rectifier provided with diesel engine. This is to ensure that failure in the other lighting system does not affect the mobility of the car.

6.8.2 Head light
Twin Beam head lights shall be provided at both ends. The head light shall conform to RDSO’s specification No ELRS/SPEC/PR/0022(Rev-1) Oct,2004. The operating voltage of head light shall be 24 V DC.

6.8.3 Tail light
Two aspect (red and white) LED type 24 V 15 W tail light shall be provided at each end to comply with general rule of Indian Railway.

6.8.4 Flasher light
LED Flasher light as per RDSO’s specification No ELRS/SPEC/LFL/0017(Rev.1) Sept 2004 or latest shall be provided.

6.8.5 Marker Light
LED Marker light as per RDSO’s specification No ELRS/SPEC/ PR/0022(Rev.1) Oct 2004 or latest shall be provided.

6.9 Search Light
Car shall be provided with two 250 W searchlights with halogen lamps one on each end for inspection of the overhead equipment while on the run. Searchlight shall provide a high intensity illuminating beam and capable of swiveling on universal joint type supports.

6.10 Wipers-electrical operated wipers to be provided.
Annexure-I

List of Drawings/calculations to be submitted to RDSO for approval before undertaking manufacture of prototype OHE Recording car

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Particulars to be supplied for in respect of OHE recording car alongwith the tender offer

The following data shall be supplied with the tender offer:

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<td></td>
</tr>
<tr>
<td>4</td>
<td>Distance between side buffers</td>
<td>mm</td>
</tr>
<tr>
<td></td>
<td>Height of buffers when wheels are new and fully worn out.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Maximum height of the car with wheels in new condition.</td>
<td>mm</td>
</tr>
<tr>
<td>6</td>
<td>Maximum height of the cab at corners with wheels in new condition.</td>
<td>mm</td>
</tr>
<tr>
<td>7</td>
<td>Maximum width of the car.</td>
<td>mm</td>
</tr>
<tr>
<td>8</td>
<td>Minimum height above rail level</td>
<td>mm</td>
</tr>
<tr>
<td></td>
<td>of any component with the car wheels in maximum worn conditions.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Reduction in the above height in the event of spring rigging failure.</td>
<td>mm</td>
</tr>
<tr>
<td>10</td>
<td>Diameter of wheels over tread (New/worn.)</td>
<td>mm</td>
</tr>
<tr>
<td>11</td>
<td>Height of the center of gravity of car above rail level.</td>
<td>mm</td>
</tr>
<tr>
<td>12</td>
<td>Axle load maximum/minimum.</td>
<td>t</td>
</tr>
<tr>
<td>13</td>
<td>Adhesive weight.</td>
<td>t</td>
</tr>
<tr>
<td>14</td>
<td>Total weight of the car.</td>
<td>t</td>
</tr>
<tr>
<td></td>
<td>- in fully loaded condition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- in empty condition</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Maximum speed of the car.</td>
<td>km/h</td>
</tr>
<tr>
<td></td>
<td>- Geared</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Safe vehicular</td>
<td>km/h</td>
</tr>
<tr>
<td>16</td>
<td>Maximum tractive effort at rail</td>
<td>kg</td>
</tr>
<tr>
<td>17</td>
<td>Maximum continuous tractive effort</td>
<td>kg</td>
</tr>
<tr>
<td>18</td>
<td>Maximum speed of operation at maximum continuous tractive effort.</td>
<td>km/h</td>
</tr>
<tr>
<td>19</td>
<td>(a) Fuel oil consumption at 75% of rated output of the diesel engine.</td>
<td>l/h</td>
</tr>
<tr>
<td></td>
<td>(b) Lubricating oil consumption at 75% of rated output of the diesel engine.</td>
<td>l/h</td>
</tr>
</tbody>
</table>
PARTICULARS TO BE SUPPLIED BY SUPPLIER

1. The following particulars pertaining to diesel engine and auxiliary equipment shall be submitted by the tenderer.

1.1 Diesel Engine

- General Data
  1. Exact description and model of the engine
  2. Rated output of the engine under site condition
  3. Rated engine speed
  4. Number and arrangement of cylinders
  5. Cylinder bore
  6. Piston stroke
  7. Compression ratios
  8. Mean piston speed
  9. BMEP at rated output
  10. Normal no load idling speed
  11. Peak firing pressure
  12. Full test result and data pertaining to engine tests
  13. Specific fuel consumption at various throttle position with tolerance band and site conditions. Indicate the lower calorific value of the fuel used in arriving at the specific fuel consumption figure.
  14. Fuel oil consumption at idle speeds (normal & low)
  15. Lube oil consumption at rated output as percentage of fuel oil consumption
  16. De-rating calculation for site condition
  17. Safety devices provided
    - Over speed
    - Low lube oil
    - Overload
    - High cooling water temperature
    - High lube oil temperature
    - High exhaust temperature
    - High intake temperature
    - Any other
  18. Number of engines of this type in traction service
  19. Weight of engine excluding oil and water
  20. Weight of water contained in the engine
  21. Weight of oil contained in the engine
  22. Weight of major equipment
    - Turbocharger
    - Charge Air cooler
    - Crank case bare
    - Piston and connecting rod
    - Cylinder liner
    - Cylinder head
23. Temperature of exhaust gas at turbo inlet at rated output under site conditions
24. Method of starting giving details of equipment
25. Estimated period between top and major overhaul
26. Periodicity of overhauling the following critical items
   - Turbocharger
   - Piston and piston rings
   - Air and exhaust valve
   - Main bearings
   - Connecting rod bearings
   - Fuel injection pump
   - Fuel injectors
27. Special design features of engine high-lighting the measures which have been taken to achieve:
   - Lower specific fuel consumption
   - Lower lube oil consumption
   - Reduced thermal and mechanical loading of critical components
   - High reliability
   - Maximum availability
28. General arrangement and dimensional details
29. Characteristic curves for torque, output and specific fuel consumption for different setting of the fuel injection pump
30. Torque-speed curve, which the manufacturer considers to be the maximum torque that should be used for rail traction.
31. The curve of fuel consumption for no-load running commencing from the minimum idling speed, expressed in kg/h.

1.2 Air compressor
1. Make
2. Model
3. Maximum pressure
4. Capacity (at idle & full speed of engine)
5. Installation drawing showing overall dimensions.
6. Weight - dry/full supply
7. Cooling
8. Graph showing speed Vs. horse power & capacity

1.3 Auxiliary Alternator
1. Make
2. Model
3. Continuous / short time rating with details of voltage and current regulation
4. Installation drawing showing overall dimensions.
5. Weight

1.4 Traction Motors
1. Make
2. Type
3. Maximum input hp
5. Continuous / short time rating with details of voltage and current regulation
6. Installation drawing showing overall dimensions.
7. Weight

1.5 Reversing Arrangement
   Method of reversing with full details

1.6 Axle Drive Gear and pinion
1. Type of gearing
2. Module
3. Grade of steel used for pinions and gears
4. Particulars of heat treatment
5. Kilometerage guarantee for bull gears
6. Kilometerage guarantee for pinions
7. Material and type of construction for gear case.

1.7 Traction Alternator
1. Make
2. Model
3. Continuous / short time rating with details of voltage and current regulation
4. Installation drawing showing overall dimensions.
5. Weight

1.8 Hydraulic pump for cooling system
Type (fixed/variable)
Model
Make
Flow rate (LPM@speed)
Pressing setting
Maximum permissible leak off
HP consumed

1.9 Hydraulic motor for cooling system
1. Type (fixed/variable)
2. Model
3. Make
4. Flow rate (LPM@speed)
5. Pressing setting
6. Maximum permissible leak off
7. HP consumed

4.0 Details of measuring equipments
1. Make
2. Model

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