Global expression of interest (EOI) for selection of vendor for

Measuring & recording Instrumentation (MRI) System

For

Self-Propelled 8-WHEELER

Diesel electric Inspection & maintenance car

(Prepared) **(Checked)** **(Approved)**

1. Introduction: -

BHEL is a leading Government of India owned Public Sector Undertaking nearly 63% of BHEL's equity is owned by the Government of India. BHEL is an integrated power plant equipment manufacturer and one of the largest engineering and manufacturing organizations in India catering to the infrastructure sectors of Indian economy. In transportation sector, we are manufacturing 25 kV AC/ 1500 V DC electric locomotives up to 5000 HP, Diesel Electric Locomotives from 350 HP to 2600 HP rating, electric propulsion equipment for AC, AC/DC and 3 phase electric locomotives, diesel electric locomotives, AC & AC/DC electric multiple units, diesel electric multiple units etc.

Indian Railway has floated an E-global tender no. RE2015TWMRI0001 for procurement of design, manufacture, supply, testing & commissioning of 29 nos. self-propelled 8-wheeler inspection & maintenance car of diesel electric under slung type with measuring and recording instrumentation system (MRI) for operation on broad gauge (1676mm) electrified (25 KV AC) routes of Indian railways.

The complete machine is broadly a combination of two parts:-

I. **Vehicle part (done by BHEL):** - Design, manufacture, supply, testing & commissioning of self-propelled 8-wheeler inspection & maintenance car of diesel electric under slung type for Operation on Broad Gauge (1676 mm) Electrified (25 KV A.C.) as per Technical Specification No. TI/SPC/OHE/8WDETC/0092 of August'.

II. **MRI Parts** - Measuring and recording instrumentation (MRI) as per Technical Specification TI/SPC/OHE/ MRI/0140 of Nov. '2015.

For measurement & recording of OHE parameters a sophisticated Instrumentation system is required. This specification pertains to the Design, manufacture, testing , supply, retro fitment /installation and commissioning of OHE Parameter Measuring & Recording instrumentation system (MRI) on self-propelled 8-Wheeler Diesel Electric Tower Car operating on broad gauge (1676mm) electrified (25 kV A.C.) routes of Indian Railways.

2. Brief Description of EOI Process:-

I. The EOI process involves selection of interested parties/ groups who make an application in accordance with the provisions of this EOI (the "Applicant"). At the end of this process, BHEL expects to select Applicant(s) who shall be invited for further deliberations on requirements regarding supply , install and commission the measurement & recording system. Also, the party is required to provide 5 years AMC of measurement & recording system after expiry of warranty period.

II. The EOI in 2 copies (original plus one) can be submitted by hand or sent by Registered Post so as to reach before **14:00 Hrs on 4th June 2016** at the following address. EOI received after the due date for submission (and any extension thereof) will not be considered. Alternatively, a signed copy of the EOI may be sent by e-mail as advance copy to be followed by original signed copy which shall be received within 7 days of e-mail.

To,
Dy. General Manager / LME
Locomotive Engineering Division,
Bharat Heavy Electricals Limited
Jhansi – 284120, Uttar Pradesh, India
Telephone: +91-510-2412263, 2412506
Fax: +91-510-2412114
Email: vinodkumar@bheljhs.co.in, umeshkumar@bheljhs.co.in

III. Any request for further information or clarification on the EOI document may be submitted in writing to AGM / LME & LFE at the above address. BHEL may respond to the queries raised / clarifications sought to the best of its ability. However, no extension of the time or date of EOI submittal would be granted on the ground that BHEL has not responded to any query / clarification raised by any party.

3. Eligibility Criteria: -

To determine the eligibility of Applicants for supply of the instrumentation system for measurement and recording the OHE parameters, following eligibility criteria shall apply: -

The Applicant for pre-qualification & selection under the EOI may be

- a single entity; or
- a Group of Entities ("GOE"). The GOE shall elect one of their members as the lead member of the GOE. The term Applicant used herein would apply to both a single entity and the GOE. The lead member of the GOE would be responsible to BHEL for the entire scope of work and shall ensure back to back tie ups with other members of the GOE. The lead member of the GOE or the single Applicant has to meet either of the Technical Capability criteria under listed below. An Applicant shall not have a conflict of interest that affects the EOI Process. Any Applicant found to have a conflict of interest shall be disqualified. An Applicant shall be deemed to have a conflict of interest if a constituent this GOE is also a constituent of another Applicant.
- For being eligible to pre-qualify and subsequent selection, an Applicant shall fulfil the following conditions of eligibility:-

(i) The offered system should be capable of measuring all OHE parameters as required in this Indian Railways tender and is running successfully on the tower wagons / inspection car. At least 5 nos. of such system should have satisfactory performance for a minimum period of two years on the date of tender opening. Applicant to submit documentary evidence (certificate issued by user Railway) along with EOI response.

(ii) Applicant should have minimum yearly turnover of INR 100 Crore in last 5 financial years. In case of GOE the lead member should have yearly turnover of INR 100 Crore in last 5 financial years and all other members of GOE should have positive turnover. Applicant to submit documentary evidence

(iii) The single entity applicant shall have a minimum Net-Worth of INR 200 crores at the close of the preceding financial year. In case of GOE Applicant, the Net Worth of lead member has to be a minimum of INR 200 crores and net worth of each GOE member has to be positive. For conversion of foreign currency, the exchange rate for the currency on the applicable date, as per RBI may be used. Applicant to submit documentary evidence for Net-worth.

(iv) Applicant should be willing to submit PBG of Measuring & Recording instrumentation system (MRI) during ordering stage. A letter regarding willingness for PBG to be submitted along with EOI response.

4. Technical description of Instrumentation System & Parameters to be measured :-

For demonstrating technical capability and experience, the Applicant shall have supplied, installed / integrated on car, commissioned and provided AMC to user Railways of their supplied instrumentation system for measuring & recording of OHE parameters.

A brief description of our requirement are as below-

I. The instrumentation system shall be able to measure and record the required parameters in the speed range 0-110 kmph, when running in self-propelled mode/coupled to a train.

II. The system requirement shall be on line recording, storing and online processing. In this setup, video recording of the OHE shall be carried out and shall process on line with on board computer kept in the Tower Car to process the necessary information of the OHE geometry parameter. The hot spot on the OHE shall be detected using Infra-Red camera and this shall also be processed online on on-board computer. Processed report of OHE geometry from the on-board computer to the nominated Railway Official sitting at the Remote Control Centre through internet shall be transmitted.

III. The tenderer shall give offer with complete technical details including processing software for analysis of OHE Geometry and report generation. The software shall be capable of exporting data to MS office for analysis.

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

V. The pantograph of Tower Car may be fitted with instrumentation such as transducers, accelerometer, load cells and strain gauges etc. as required but such fitment shall not materially affect the static/dynamic performance of the Tower 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 -65 Protection.

VI. The communication between exterior/roof mounted and interior instruments on board computer/laptop shall be made by an Ethernet Network and physical connection is made by optical fiber. All cables on the roof of tower car which are connected to ground level shall be put in a metallic grounded protection pipe.

VII. All processed information shall be made available in the Laptop/Desktop at the suitable location in the Dome Area or Staff Cabin of Tower Car. The connections from instrumentation on the roof of the car to the place inside the Tower Car shall be rigid enough to avoid any failure due to poor connectivity during movement of Tower Car due to vibrations. Necessary minor modification work for keeping Laptop/ Desktop, UPS, Printer and power supply arrangement for Laptop/ Desktop, Printer shall be in the scope of supply.

VIII. The tenderer 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 worldwide Railways.

IX. The electric supply shall be made available from 7.5 kVA DG set, 440V, 3 phase supply. The tenderer shall draw single phase supply from DG Set for supply to UPS.

4.1 The parameters that instrumentation system is required to measure and monitor are detailed as follows:-

a. Stagger of Contact wire :-

Stagger is defined as the distance of the contact wire from the center-line of pantograph, measured transverse to the track. (Suitable cant compensation shall be made for transverse oscillations of the locomotive/OHE 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 200 mm.

b. Height of 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 6500 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 Car shall be able to measure heights of two 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 1000 mm

c. Measurement of contact wire thickness (contact wire diameter) :-

Thickness implies the diameter of Contact Wire. There are three sizes of contact wire i.e 107 mm^2, 150 mm^2 and 193 mm^2 and their diameters are 12.24 mm, 14.50 mm and 16.40 mm respectively. The condemning limits of their diameters are 8.25 mm, 8.25 and 9.75 mm respectively. The measurement of diameter of contact wire may be made using any non-contact measurement method. The accuracy of contact wire thickness measurement shall be minimum + 0.2 mm. Sampling distance shall be 500 mm.

d. 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 10 lakh masts and transfer it for printing of reports.

e. Loss of Contact :-

Loss of contact with pantograph and contact wire is required to be continuously monitored. For this continuous recording/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.

f. 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.

4.2 Recording & Presentation of Test Results:-

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.
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 exceedance of certain threshold values. The processing software shall take care of the requirement of IR gauge and OHE for the purpose.

4.2.1 Recording Facility:-

1. 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 1000 kms or 90 days whichever is less.
2. All measured and recorded data shall be converted from analog to digital form, classified, analysed and stored on an On-Board computer based data acquisition and analyzer system. It shall be possible to generate suitable reports involving simple logic from the database.
3. 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.
4. 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.

5. EMI Requirements:-

1. OHE The instrumentation shall be work under 25 kV, 50 Hz, OHE System environment. Electronic signals generated inside the measuring equipments, inverters shall work without any adverse performance.
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. The electric and electronic equipment used in the measuring & recording instrumentation 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 Car:

   Psophometric Current <=5 A

   100 Hz - 400 mA
   1700 +/- 50 Hz - 300 mA
   2000 +/-50 Hz - 300 mA
   2300 +/- 50 Hz - 300 mA
   2600 +/-50 Hz - 300 mA
   5100 +/-50 Hz - 100 mA
4. Emission from Tower 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.

6. Inspection & Testing of Measuring Instruments:-

1. Successful tenderer shall arrange all facilities to conduct performance tests of the measuring instruments as per the required features of the instrument.
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. The tests related to design & other physical parameters shall be witnessed by the authorised representative of purchaser at supplier's premises.

7. Annual Maintenance Contract (AMC) & Warranty:-

The Supplier shall also be responsible for AMC of all Equipments/Components of 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 5 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, 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 of Measuring system covering scheduled as well as break down 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.

Warranty period shall be 30 months from the date of delivery or 24 months from the date of installation, whichever is earlier.

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

During warranty period, scheduled maintenance of Measuring Equipment/ Components shall be done by the successful contractor for which no extra cost shall be paid by the Railways. After expiry of Warranty period, the successful Tenderer shall have to maintain all the instrument/ Components of the Measuring System during AMC period of 5 years. The Equipment, other than measuring instrumentation/ Components, shall be maintained by the Railways.

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.

Note-

1. **For detail please refer to attached Railway board tender spec. No. RE2015TWMRI0001**
2. **In case of ambiguity, Railway board tender spec. No. RE2015TWMRI0001 shall prevail**

(Prepared) **(Checked)** **(Approved)**