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EXPRESSION OF INTEREST

for Hiring

"Independent Safety Assessment Services for SIL (Safety Integrity Level) Certification of TCMS Control function - EMU (36 Sets) project"

Issued by:

Bharat Heavy Electricals Limited,

Mysore Road, Bangalore -560026 (hereinafter referred to as 'BHEL')

also

having its registered office at

BHEL House, Siri Fort New Delhi-110049, INDIA

DISCLAIMER

All information contained in this EOI provided / clarified are in good interest and faith. The information contained in this Expression of Interest document or subsequently provided to Bidder(s), whether verbally or in documentary or any other form, by or on behalf of BHEL, is provided on the terms and conditions set out in this EOI and such other terms and conditions subject to which such information is provided.

The purpose of this EOI is to provide interested parties with information that may be useful to them in the formulation of their application for qualification and subsequent selection pursuant to this EOI. This EOI is not an offer by BHEL to the prospective Bidder(s) or any other person. This EOI is neither intended nor shall it be construed as creating or requiring any ongoing or continuing relationship or commitment with any party or person. This is not an offer or invitation to enter into an agreement of any kind with any party.

Though adequate care has been taken in the preparation of this EOI document, the interested firms shall satisfy itself that the document is complete in all respects. The information is not intended to be exhaustive. Interested Agencies are required to make their own enquiries and assumptions wherever required. Intimation of discrepancy, if any, should be given to the specified office immediately. If no intimation is received by this office by the date mentioned in the document, it shall be deemed that the EOI document is complete in all respects and firms submitting their interest are satisfied with the EOI Document in all respects.

The issue of this EOI does not imply that BHEL is bound to select and shortlist Bidder(s) for next stage or to enter into any agreement(s) with any Bidder(s). BHEL reserves all right to reject any applications submitted in response to this EOI document at any stage without assigning any reasons thereof. BHEL also reserves the right to withhold or withdraw the process at any stage. Neither BHEL nor its employees and associates will have any liability any loss, expense or damage which may arise from or be incurred or suffered in connection with anything contained in this EOI document or any matter deemed to form part of this EOI document, the information and any other information supplied by or on behalf of BHEL. BHEL accepts no liability of any nature whether resulting from negligence or otherwise howsoever caused arising from reliance/use of any statements/information contained in this EOI by the Bidder. BHEL is not making any representation or warranty, express or implied, as to the accuracy or completeness of any information/statements made in this EOI.

The Bidder shall bear all its costs associated with or relating to the preparation and submission of its Application including but not limited to preparation, copying, postage, delivery fees, expenses associated with any demonstrations or presentations which may be required by BHEL or any other costs incurred in connection with or relating to its Application. All such costs and expenses will remain with the Bidder and BHEL shall not be liable in any manner whatsoever for the same or for any other costs or other expenses incurred by an Bidder in preparation or submission of the Application, regardless of the conduct or outcome of the EOI.

1.0 INTRODUCTION

This Expression of Interest (EOI) seeks response from RDSO empanelled Safety Certification and Inspection bodies who are offering Independent Safety Assessment (ISA), Certification & Functional Safety Professional training services for Safety in Railway Systems & technologies as per CENELEC standards EN50126, EN50128 and EN50129: CENELEC is the European Committee for electrotechnical standardization. ISA & SIL certification is required for Control functions integrated in the TCMS (Train Control & Management System) for EMU project (36 Sets).

2.0 ABOUT BHEL

Bharat Heavy Electricals Limited (BHEL) is a Central Public Sector Enterprise, wherein Government of India is holding 63.06% of its equity. It is an integrated power plant equipment manufacturer and one of the largest engineering and manufacturing companies of its kind in India having a turnover of about USD 5 billion. The company is engaged in the design, engineering, manufacture, construction, testing, commissioning and servicing of a wide range of products and services for the core sectors of the economy, viz. Power, Transmission, Industry, Transportation, Renewable Energy, Oil & Gas and Defence with over 180 product offerings to meet the needs of these sectors.

Since its inception in the year 1964, BHEL has been the solid bedrock of evolution of India's Heavy Electrical Equipment industry. BHEL has a mammoth 20,000 MW per annum capability for manufacturing of power generation equipment. A widespread network of 17 manufacturing units, 2 repair units, 4 regional offices, 8 service centres, 1 subsidiary, 4 overseas offices, 6 joint ventures, 15 regional marketing centres and current project execution at more than 150 project sites across India and abroad corroborates the humongous scale and size of its operations.

With key focus on project execution, the worldwide installed base of power generating equipment supplied by BHEL has exceeded 178 GW. BHEL's equipment that account for about 60% of the country's total generation from thermal utility sets (coal based), stand a testimony to its valuable contribution towards nation building. BHEL's global competitiveness has established its footprint in all the inhabited continents with references in 82 countries.

The high level of quality & reliability of BHEL products is a testimony to its adherence to international standards by acquiring and adapting some of the best technologies from leading companies in the world including General Electric, Siemens AG, Mitsubishi Heavy Industries Ltd. etc., together with technologies developed in its own R&D centres. BHEL invests more than 2.5% of turnover on R&D and innovation.

BHEL has been designing and manufacturing rolling stock for rail and urban transportation. BHEL has also been manufacturing Motors, Power electronics and Controllers for various

transportation applications at its various factories. BHEL also has a Battery Packaging facility for space applications.

In transportation sector, BHEL is into the manufacture of complete electric and diesel electric locomotives and electrical assemblies/components including traction motors, traction transformers, power & auxiliary converters and controls, gear wheels etc.

At Jhansi plant, we manufacture complete Electric Locomotives up to 6000 HP rating for mainline application of Indian Railways, Diesel Electric Locomotives from 350 HP to 3100 HP rating. Till date, we have supplied more than 400 nos. of main line electric locomotives for Indian Railways and more than 350 nos. of diesel electric locomotives for shunting operations to different industries. We are currently executing an order for manufacture of complete Electric Locomotive of 6000 HP. Our Jhansi plant with an installed capacity of 75 nos. locomotives per year. At Jhansi, we have complete state-of-the-art facilities for manufacturing, fabrication and testing of bogies, loco shells, under frames and other mechanical components of locomotives. We have recently developed India's first state-of-the-art WAG7 Electric Locomotive with regenerative capabilities. We have also developed India's first Traction Motor for 9000HP Electric Locomotives.

At Bhopal and Bengaluru plants, among electrical propulsion equipment, we manufacture and supply traction motors, traction transformers, power converters (IGBT/GTO) & controls, auxiliary converters (IGBT/GTO) and vehicle control units for electric locomotives, diesel electric locomotives, EMUs, MEMUs, DEMUs & and metros trains of Indian Railways. We are part of prestigious Make in India Vande Bharat project of Indian Railways which is under design stage. Our manufacturing range includes conventional DC drive, IGBT based 3-phase drive equipment up to 6000HP rating. BHEL has also been in the forefront of providing maintenance and spares/replacement support to Indian Railways for their locomotive fleet. We have full-fledged service team stationed at major centers in the country.

More details about the entire range of BHEL's products and operations can be obtained by visiting our web site www.bhel.com.

3.0 PURPOSE

3.1 BHEL is a regular supplier of TCMS, traction propulsion equipment to Indian Railway production units for manufacturing of EMUs, MEMUs, Metros & Trainsets by them.

3.2 Indian Railway is on a rapid expansion and modernisation drive for its rolling stock to increase the average speed of operations and to enhance safety and comfort of passengers. The modernization in railway technologies have become increasingly complex over time. These developments have made railway safety assessments not only more necessary but more challenging.

3.3 **BHEL is executing PO No.: 08220199D01461 dated 12.05.2022** from ICF, Chennai for Design, Development, Manufacture, Supply, testing and Commissioning of microprocessor controlled IGBT based 3-phase propulsion equipment for EMU 36 Sets (on board – 12 car rake) as per RDSO specification No. RDSO/PE/SPEC/EMU/0163 (Rev-2) with corrigendum's and addendums.

3.4 RDSO technical specification for the project requires TCMS software to be designed as per CENELEC Standards EN 50126, EN 50128, EN 50129 and EN50159. For Control functions integrating in the TCMS, the requirements of EN 50126 and EN 50128 shall be applied. In particular, the risks associated with the integration of any control function shall be assessed and the design of TCMS (SIL Level according to EN 50128) shall reflect the level of risk identified.

3.5 The intent of this EOI is to invite proposals from RDSO empanelled Safety Certification and Inspection bodies who are willing to offer services of ISA for the safety related functions of TCMS.

4.0 BROAD SCOPE OF REQUIREMENT

4.1 The safety related functions of TCMS requires SIL certification are tabulated below along with applicable standards:

S.No.	Requirement	Description
1.	Applicable Standards	[1] EN 50126-1:2017 Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 1: Generic RAMS Process [2] EN 50126-2:2017 Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 2: Systems Approach to Safety [3] EN 50128:2011+A2:2020 Railway applications - Communication, signalling and processing systems - Software for railway control and protection systems [4] EN 50657:2017 Railways Applications - Rolling stock applications - Software on Board Rolling Stock [5] EN 50129:2018 Railway applications - Communication, signalling and processing systems - Safety related electronic systems for signalling [6] EN50159:2010+A1:2020 Railway applications - Communication, signalling and processing systems - Safety-related communication in transmission systems
2.	ISA & SIL Certification	As per above EN standards and international practices, ISA and SIL validation and certification (minimum SIL 2 Compliant) shall be done for the TCMS vital and safety related control & monitoring functionalities as listed below: 1) Emergency brake 2) Standstill detection 3) Vigilance control 4) Speed control 5) Roll back detection 6) Speed indication 7) Traction release 8) Smoke and Fire detection A brief write-up on the above functions is available in Annexure-3

4.2 For the intended scope of requirement, the bidder shall submit their detailed proposal along with unsigned price bid. The proposal shall consist of clear break up of activities along with timelines and requirements from BHEL for obtaining SIL certification.

4.3 The bidder shall include any training to be imparted to BHEL personnel for SIL certification.

4.4 The first rake of the project will be available for field trials during November, 2023 (tentatively) for assessment, if any.

4.5 Interested RDSO empanelled Safety Certification and Inspection bodies may submit their proposal for above scope of requirement. Eligibility requirement are as per Annexure -1.

5.0 INSTRUCTIONS TO BIDDERS

5.1 The corrigendum subsequent to EOI, if any shall be floated on BHEL website www.bhel.com

5.2 Detailed scope will be finalised during Request for Quote (RFQ) process stage following this EOI.

5.3 The submitted proposal shall also include comments on the scope of requirement & criteria's, if any.

5.4 General Information to be submitted by bidder(s) as per Annexure-2 for evaluation.

5.5 The details submitted by the Bidder(s) shall be complete in all respects and BHEL may seek clarifications/additional information as considered necessary. Such clarifications/additional information must be provided within 7 days of BHEL request.

5.6 BHEL shall shortlist suitable ISA who meet Pre-Qualification Criteria (PQR) as per Annexure -1 for the intended services.

5.7 BHEL shall publish a RFQ addressed exclusively to shortlisted Safety Certification and Inspection bodies for the following procurement process through the eProcurement Portal. BHEL may issue notification / alerts to such service providers but without any liability. It shall be the responsibility of such Safety Certification and Inspection bodies to be on the lookout for the RFQ on the Portal. Nothing in this EOI shall impair the BHEL's right to issue 'Open RFQ' for the subject Services, even after notifying the shortlist. During the RFQ process, BHEL reserves its right to elaborate further on the brief overview of the proposed scope of work, qualification Criteria and any other terms & conditions, even if these are at variance with this EOI Document.

5.8 The ISA shall also be required to enter into mutual non-disclosure agreement (**NDA)** with BHEL during the contractual award stage.

5.9 Responses to EOI are to be submitted in English only. Supporting documents, as required, should also be in English language. In case of some documents being available in languages other than English, the Bidder shall necessarily provide duly authenticated translated version of the same in English.

5.10 Duly authorized representative of the Bidder(s) shall sign on each page of the document. Response to EOI should be prepared in such a way so as to provide a straight forward, concise description of Bidder's past experience and credential / accreditations, if any.

5.11 Notwithstanding anything contained in this EOI, BHEL reserves the right to accept or reject any Application and to annul the EOI Process in whole or part, at any time without any liability or any obligation for such acceptance, rejection or annulment, and without assigning any reasons thereof.

5.12 BHEL reserves the right to verify all statements, information and documents submitted by the Bidder in response to the EOI. Any such verification or lack of such verification by BHEL shall not relieve the Bidder of his obligations or liabilities hereunder nor will it affect any rights of BHEL.

5.13 The EOI process shall be governed by, and construed in accordance with, the laws of India and the Courts at Bangalore shall have exclusive jurisdiction over all disputes arising under, pursuant to and/ or in connection with the EOI process.

5.14 All costs incurred for participation in the EOI shall be borne by the Bidder(s).

5.15 Any request for further information or clarification on the EOI document shall be submitted to the below mentioned official within 07 days from date of issue of EOI.

5.16 **Bid Submission:** Reputed business entities shall submit their detailed proposal including unsigned commercial offer by Post / e-mail so as to reach us on or before 13:00 Hrs on **21st April, 2023** at the following address:

Mr. Devanand V, Senior Deputy General Manager
Bharat Heavy Electricals Limited,
Electronics Division, PB No. 2606,
Mysore Road, Bangalore – 560 026,
India.
Email: devanand@bhel.in;
sunilkumarv@bhel.in; narasimhayadav@bhel.in
Mobile: +91 94490 80219; Telephone: +91 80 2699 8652 / 8445 / 8039

Annexure-1

Pre-Qualification Requirements

S.N.	Requirement	Bidder's Response	Supporting document
1	The ISA should possess valid accreditation as per ISO/IEC 17065 and recognized by the most international accreditation bodies like UKAS, ANAB etc. on the day of bidding.		Accreditation copy self-certified.
2	The bidder or their Indian subsidiaries / counterparts / representatives should be RDSO empaneled ISA.		The firms on the RDSO ISA panel may authorize their Indian counterpart offices / representatives for ease in co-ordination, communication and bidding on behalf of the ISA firm. Authorization may be communicated to the BHEL directly. **Please note that - assessment, certification etc. for the project shall be done by the ISA firm on the RDSO panel and not by the representatives.**
3	The bidder should have satisfactorily completed minimum 05 (five) number ISA certifications (minimum SIL 2) for railway safety application as per CENELAC standards like EN 50126, EN 50128 (EN 50657), EN 50129& EN 50159 to Government/PSU/Private Agencies in India or Globally		Copy of Work / Purchase orders along with acknowledgements from Customer / consultant & SIL certificate.
3	The bidder should not be in the black-listed / banned list of agencies of any Govt. authority / department or by any BHEL Unit / Region / Division / Office for any business dealings.		An undertaking on company letter-head and signed by an authorized signatory of the company stating that the bidder is not currently in the blacklist or banned list.
4	The bidder should have valid PAN No. and GST Registration number.		Documentary proof to be submitted
5	Has not suffered insolvency / bankruptcy		Declaration, copy of Audited Balance sheet for last three financial years

(Sign & Company Seal)

Authorized signatory

NOTE:

1. Any other documents considered relevant to meet PQR and to support evaluation criteria are to be submitted.
2. Bidders with deviations to the above mentioned PQR are also encouraged to submit their proposal. However, acceptance/suitability of such responses shall rest with BHEL and same decision shall be final and binding.

Annexure-2

General Information to be submitted by Bidders

1. Name of the Company:
2. Legal status of the Company:
3. Brief description of the Company including details of its business groups/subsidiaries/ affiliates:
4. Date of Incorporation:
5. Date of Commencement of Business:
6. Full address including Telephone nos. / Fax nos.:

   Registered Office:

   Head Office:

   Address for communication:

   Contact Details:

   Office Address in India, if any:
7. Documents to be enclosed:
   a) Technical Credentials –Experience / Reference List, Copies of Customer Certificates / acknowledgements, strengths, accreditations, etc.
   b) Financial Credentials – Copies of Audited Financial statements (Annual Reports) for last 3 years, Credit Rating, Market share (Domestic/International).

(Sign & Company Seal)

Authorized signatory

Annexure-3

Brief write-up on the TCMS safety functions

Train Control & Management System (TCMS):

Train Control & Management System (TCMS) is a heart of any propulsion system. TCMS controls and monitors all the important parameters from line side, motor side and control side of the propulsion. It establishes and interface other sub-systems like door, pantograph, brake fire detection, passenger alarm, VCB etc.

It monitors the life signal of all processor cards, if any processor cards fail to respond TCMS in a provided time then it isolates the system and declared it to be dead. The same phenomenon is also followed for every signals transmitted from processor cards, if life sign is not updated, the signal is not validated. TCMS commands other system to take protective shutdown in case of any malfunction.

TCMS provides the status (healthiness and failure) of the system and sub-systems on Driver display unit (DDU), even it helps to diagnose any issue related to sub-system.

The safety control & monitoring functions for SIL certification are briefed below:

1) **Emergency brake**

   The Emergency Brake is aimed to stop the running train in the shortest time (under the assumption there is no wheel slide) in order to reach the safe condition of the train (standstill). Fast and complete venting of the Brake Pipe (BP) initiated by the driver/ guard by moving the brake handle into the emergency brake position. Application of emergency brake by moving the master controller in the emergency brake position, causes the opening of the emergency brake loop. Alternative, emergency brake is applied through other functionalities like vigilance control, dead man, TCAS (Train Collision avoidance system) etc.

   The Emergency Brake system shall perform the following activities:

   - Cut-off the electric traction (both driving and braking)
   - Apply all the available friction brake force (without jerk control)
   - Indicate to the driver that Emergency Brake is active
   - Activate EP-brake in parallel to shorten the time for emergency brake activation (in case EP-brake is available).

2) **Standstill detection**

   This is the most important function of the train as it is the safest situation for the train. In standstill state of the train, holding brake is always applied. The purpose of this function is to detect the speed of the train is zero and train is not moving. In case, movement is detected, Emergency brake shall be applied.

3) **Vigilance control**

   The VC is for monitoring alertness of the Driver through a system which gets reset by specified normal operational activities of the Driver, in addition to acknowledgement of the vigilance check by pressing a pedal/foot switch provided for Driver for this purpose [optional]. Absence of the normal driving functions or the acknowledgement at specified intervals shall activate vigilance control system to flash an indication. If after a specified duration, VCD is still not acknowledged then it shall cause audio warning. If audio warning is also not acknowledged after a specified period, it shall result in emergency brake application.

4) Speed control

The purpose of this function in train is to control the speed in the TCMS. It monitors a train speed to ensure that train passes a signal with safe speed. It collects speed reference from safe speed signal unit, speed sensor of motors, Faulty condition (Network Failure, EP brake Faults) or any other speed limitation like shunting operation, inching mode operation or RDM mode.

It will also take care of the cruise control as well as over-speed limitation

5) Roll back detection

The purpose of this function in train is that, the train should not roll back. The rollback is possible when the traction or braking effort is asked by the driver is too little. During this time is the speed measured is negative 0.5m/s (Max), the roll back function will be activated and the holding brake is applied. The function will be deactivated when the train has come to standstill and the driver has put the Master Controller in the Neutral position.

6) Speed indication

The purpose of this function is to ensure / show / display safe and accurate speed of the train on speedometer to the driver. It is a continuous function and always show speed when the train is moving in forward or backward direction.

7) Traction release

Traction release function is used to enable / disable the traction converter for taking movement of the train. If the output of the function is low, driver cannot move the train. If enabled, driver is allowed to take movement of the train after checking all the required safety inputs (like Door close status, MR Pressure feedback, BP Pressure feedback, brake status, emergency off condition etc.). If any of the safety input is not met, then traction release should be inhibited to prevent any unsafe operation of the train movement. To implement this, separate hardwired input is generated by taking required safety inputs in series and the train line is created by combining all the safety inputs and train line input will be provided to all the traction converters in the train to prevent unsafe operation of train movement.

8) Smoke and Fire detection

The smoke and fire detection function is to detect smoke and safely evacuate passenger in case of fire. This is implemented through Fire detection control unit (FDU) and sensors in the coach passenger areas and technical cabinets. On detection of smoke / fire, the FDU will give a safe contact outputs to TCMS and also a hooter will be activated in driver cab for information to driver. The FDU can also communicate with TCMS and pass on the alarm information for taking necessary action through interfaced subsystems like closing of HVAC Radial air damper to limit outside oxygen which supports fire, opening of doors through door control system etc. The Driver will decide suitable location (not in tunnel, on bridge etc.) for informing to passengers, stop the train and open the door for evacuation.