

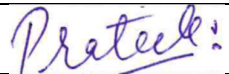


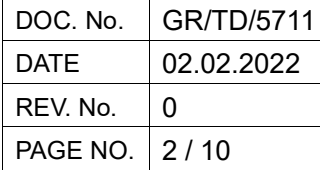


BEML LIMITED BANGALORE

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PROCUREMENT TECHNICAL SPECIFICATION FOR ULTRASONIC TESTING EQUIPMENT

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1. Introduction

To ensure safety and reliability of metro rolling stocks, axles are examined periodically for presence of cracks. This document specifies the general requirements of ultrasonic testing equipment.

The primary purpose of the UST equipment is to measure the flaws/cracks (internal as well as surface) on the steel axle body and provide quantitative & qualitative information about the thickness, depth and size of the defects present in the axle.

2. Definitions and Abbreviations

2.1. Definitions

The following definitions shall be used as applicable:

- "Employer" means end user and its legal successors and assignees.
- "Engineer" means any person nominated or appointed from time to time by the employer to act as engineer for the purpose of the contract and notified as such in writing to the contractor.
- "Engineer's Representative" means any assistant of the engineer appointed from time to time by the engineer
- "BEML" means the contractor to procure the UST equipment.
- "Vendor/Sub-contractor/OEM" means the supplier of UST equipment to BEML.
- "Equipment" means ultrasonic equipment along with all accessories and items as required for effective and efficient operation.

2.2. Abbreviations

The following abbreviations shall be used as applicable:

- GTC: General Terms & Conditions of Contract of BEML
- PTS: Procurement Technical Specifications of BEML
- RAMS: Reliability, Availability, Maintainability & Safety
- LCC: Life Cycle Cost
- OEM: Original Equipment Manufacturer
- DLP: Defect Liability Period
- UST: Ultrasonic Testing
- MRTS: Mass Rapid Transport System
- FSH: Full Screen Height
- CBC: Clause By Clause Comments
- AMC: Annual Maintenance Contract

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2.3. Climatic conditions

The vendor shall supply the equipment and if necessary, customize the same to satisfy climatic & environmental conditions of coastal climate in Mumbai, Maharashtra, India.

Some of the details are as given below:

Description	Limiting Values
Maximum temperature (See note-a below)	36°C
Minimum temperature	14°C
Humidity	≥ 95% RH
Atmosphere during hot season	Extremely dusty including bird feathers
SO ₂ level in atmosphere	80 – 120 micro gram/m ³
Suspended particulate matter in atmosphere (TSPM)	360 – 540 micro gram/m ³

Note:

- The temperature of the metal surfaces of the vehicles when exposed directly to the sun, for long periods of time, may be assumed to rise to 70°C.
- Any moisture condensation & coastal climate shall not lead to any malfunction or failure.
- Adequate margin shall specially be built into the design particularly to take care of the higher ambient temperatures, high humidity, dusty and corrosive conditions, etc. prevailing in coastal area.

2.4. Unclear aspects

If any term/clause/definition is unclear in this PTS, the vendor shall seek clarification from BEML prior to making the proposal, to confirm the same. After signing the contract, vendor shall follow the definition and opinion of design team in BEML.

2.5. Standards

- The manufacture & testing of the proposed aggregates by vendor shall conform to the latest editions of UIC/EN standards or equivalent international standards on first priority. Metric system with SI units shall be used wherever applicable.
- The vendor's own standards shall be on second priority. The vendor shall request and justify with reasonable, sufficient & necessary support documents for choosing alternate standards as compared to UIC/EN/any other international standards.
- BEML/Employer reserves the right to accept or reject any such request (s).
- The vendor shall provide the standards used in his equipment if asked by BEML. The same is considered to be in quoted price.

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3. Qualifying Criteria

- Vendor should be a reputed OEM or an authorized distributor of the proposed equipment for rolling stock. A letter of authorization along with validity period shall be submitted for review along with proposal. The vendor shall provide details of his supply experience for the same clearly stating the customer and year of supply.
- Company profile, product description, catalogue, box contents etc shall be submitted along with offer. Operating and maintenance instructions must be submitted after placement of order.
- Vendor approval (if deemed necessary) documents shall be submitted by the vendor. The vendor shall be ISO: 9001 certified.
- It is preferred that the proposed equipment shall have been in use and have established satisfactory performance and reliability on at least one mass rapid transit systems in revenue service over a period of one year or more.
- The vendor shall be capable of providing AMC support after end of warranty period. The warranty period starts after successful testing and commissioning of the proposed equipment.
- The OEM should undertake to provide technical support during warranty period either by themselves or through sister company or a partner in India. The vendor shall submit detailed proposal in this regard.
- The vendor shall also provide details of any consumable item (s) like oils, grease, couplants, paint, polish, wearing items etc. or any other items required for the proposed equipment. All such consumables shall be procured from localized/indigenous sources, especially OEMs/OEM authorized sources to a maximum extent.
- The vendor should give an undertaking to supply spares for a minimum period of 10 years from the date of commissioning of UST equipment.

4. Functional parameters

4.1. General features

The vendor shall meet the general parameters for UST equipment as per following:

- The UST equipment shall be modular in design, light weight and must be easy to handle by the operator without causing unnecessary fatigue.
- The equipment shall have aesthetic look, robust structure and suitable for both mains (AC 230V±10V, 50-60Hz) & battery operation. On battery, the equipment shall function for at least 8 hours per day without any drop in performance.
- The battery shall be re-chargeable batteries preferably Ni-MH or Ni-Cd or Li-ion battery. The battery charger must protect battery from over charging and shall have a automatic cut off provision. Necessary guidelines shall be provided for extended battery life.
- The equipment shall have a fuse so that in case of high electrical supply, the same protects the equipment from high current / voltage. The fuse shall be located in a manner which makes it easy to replace by the operator. The rating and specification of the same shall be provided.
- The equipment shall have a provision which enables the user to input / feed details like operator name, code, date, time, location, part no., type of part, location defect, observation during testing, remarks, comments etc.
- The display screen shall be colour with LCD/LED/TFT screen and

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backlight. It must be suitable for working in night time and broad day sunlight, indoor as well as outdoor in situ. The trace pattern shall be clearly visible in bright sunlight from a distance of 1000mm (1m).

- g. The equipment shall be suitable for testing axles and related components based on A-scan pulse echo technique using suitable transducers.
- h. The equipment shall be customized to suit India climatic condition, as mentioned in the section-2.3. It shall have minimum IP65 protection.
- i. The equipment shall be capable of storing calibration data (min. 50) as well as screen pattern & inspection recording (min.150 frames). A higher storage shall be possible using a memory card/pendrive.
- j. It shall have suitable port for downloading the complete data set on to a personal computing device. It shall also have a port for connecting it to printer.
- k. The equipment shall have a 10-point DAC auto plotting facility. DAC shall work as a flaw monitor gate with LED glow and alarm.
- l. The equipment shall have a battery level indicator to show its condition.
- m. The equipment shall be packed / placed in a proper carry case which prevents corrosion, dust ingress, water proof and impact during working and transit. The carry case shall have different pockets for arranging the accessories of the equipment in proper manner.
- n. Locking facility shall be an added advantage for the carrying case.
- o. The cables used shall be flexible, oil proof, durable, good quality, heat resistant and sufficient strength to withstand service condition. The junctions of the cables shall be suitably crimped.
- p. The equipment shall meet the requirements of specification IS: 12666 or EN 12668 or equivalent international standard in respect of such characteristics which have not been spelt in the PTS.

4.2. Technical features

The preferred technical requirements of the equipment shall be as per following:

- a. The equipment shall be able to work in pulse-echo and transmit-receiver mode.
- b. The equipment shall be suitable for working in frequency range of 0.5MHz to 6MHz ($\pm 20\%$).
- c. The equipment shall have a test range of at least 50mm to 5000mm. The range shall be adjustable in steps of 2mm or less preferably.
- d. The equipment shall have trace delay facility for inspecting items of length 3000mm made of steel in steps of 2mm or less.
- e. The equipment shall have minimum 120dB total gain (including internal gain). The operable gain shall be 80dB in steps of minimum 0.5dB and higher steps.
- f. The equipment must have reject / suppression /filter capacity for vertical signals from 0% to 90% (minimum) of the full screen height in increments of 1%. Amplitude of partially suppressed signals shall maintain linearity.
- g. The equipment shall be provided with two monitor gates expandable to cover entire horizontal screen display range. The level (height) of the gate shall be adjustable from 1% to 99%.
- h. The equipment shall have expansion arrangement of gated signal within full screen length.
- i. The equipment shall have an arrangement to freeze displayed wave form along with test data.
- j. The equipment shall have enough memory/storage facility to store & re-call

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data as and when required with minimum 50 calibration data and 150 wave forms.

- k. The equipment shall have arrangement for displaying standard / reference pattern in the back of patterns obtained during test for comparison.
- l. Linearity of time base: The variation shall be within $\pm 1.25\%$ at all ranges.
- m. Linearity of amplification: It shall be within $\pm 3\%$ at all ranges.
- n. Penetration power: the equipment shall give at least 5 full echoes and 6th echo appearing at 23mm Perspex (attenuation about 20dB per inch) of standard / calibration block.
- o. The dead zone shall not be more than 7mm with single crystal (2MHz) and 3mm for double crystal (4MHz) probe.
- p. The resolution shall be 6mm in steel or better.
- q. The equipment shall be capable of giving signal at least 40% of full screen height for an artificial defect of 5mm saw cut in a steel axle of length 2500mm approx. The cut shall be at a distance of 60-100mm from far end journal end. In a far end scan of this axle the reserve gain shall be at least 30dB irrespective of type of axle while picking up the above defect.
- r. Sweep drift shall not be more than $\pm 1\%$ at room temperature, 14degC and 36degC.
- s. Vertical drift shall be within $\pm 3\text{dB}$ @ 1dB/10degC between room temperature and 36degC.
- t. Signal to noise ratio shall not be more than $1/10^{\text{th}}$ of full screen height at 500mm range on 23mm Perspex of attenuation about 20dB/inch with 2.5MHz/20mm diameter probe with 5 full echoes and 6th appearing at 23mm.
- u. The trace pattern on the screen shall be free from bow, kinks and under shoots. It shall be truly horizontal and free from tilts, distortions etc.
- v. The equipment shall function normally after being subjected to acceleration of $1g$ ($g=9.81\text{m/s}^2$), frequency 10Hz to 100Hz for 30minutes.

5. Scope of Supply

- a. The vendor shall supply UST equipment along with all accessories, attachments, cables, power units etc. which enables the equipment in ready to use condition.
- b. The equipment shall have to a minimum a display device with controls, connecting cables for power, charging & data transfer, power pack (rechargeable batteries, battery charger, adapter etc.), normal and angle probes (at least 1 each) for far end scanning, high angle & low angle scanning and trace delay scanning, insulated & shock proof equipment box, calibration block, special tools (if any) for inspection & testing, maintenance spares applicable during warranty period etc.
- c. The vendor shall provide technical documentation of operation, self-help manual, device information and usage instructions, fault diagnostics, maintenance instructions, list of special tools, storage and handling instructions, box contents, equipment calibration certificate, recommended couplants, connection circuit details, technical specification of the part items etc. The medium of language shall be English and documents in colour.
- d. The vendor shall provide details of any consumable item like source, specification etc. required for the proposed equipment. If vendor fails to provide the details, the same shall be supplied during warranty period free

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of cost.

- e. The vendor shall provide training to personnel of BEML and end-user for usage and operation of the equipment along with calibration. The vendor shall demonstrate the functions and utility of the equipment on 4 motor axles and 4 trailer axles to the satisfaction of the user. The axles may be in loose (free axles) or assembled condition (as in wheelset).
- f. The vendor shall also provide a recorded video of the description and usage of the equipment. This will be used as a reference by the user during inspection.
- g. Any license required for operating software shall be perpetual i.e. which does not require renewal. Software update during warranty period shall be done free of cost by the vendor.

Sl.	Part No.	Description	Unit
1	525-81016	ULTRASONIC TESTING MACHINE FOR UST OF AXLE (as per section-5 above)	NO

6. Warranty

- a) The vendor shall provide a minimum warranty of 24 months for its supplies. In case any part of the equipment turns out to be defective (for reasons attributable to improper workmanship, design defect, inferior material etc.) during the warranty period, the warranty of the said equipment after repair/replacement shall be renewed by 24 months from the date of repair/replacement.
- b) The repair or replacement as necessary shall be done by the vendor free of cost in site, to the satisfaction of the user.
- c) The useful life of the UST equipment shall be minimum 8 years. A higher life and higher warranty will be an added advantage among different proposals for the subject item.

7. Delivery

- a. The vendor shall deliver proposed equipment as per delivery schedule mutually agreed.
- b. The vendor shall pack & deliver the UST equipment suitably to avoid any damage during transit/transportation.
- c. The manuals and technical literature shall be supplied by vendor in a week after placement of purchase order or one month before the supply of UST equipment to BEML, whichever is earlier.

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8. Compliance for PTS, ERTS & ERGS

- The vendor shall provide a valid and fully compliant proposal for the UST equipment as detailed in the PTS.
- The vendor shall submit detail clause by clause comments (CBC) for the clauses of PTS.
- Any clause of PTS for which no comments have been provided in CBC by the vendor, shall be construed as favourable to BEML.
- It is suggested that vendor shall list out all deliverables or supply elements mentioned in this PTS and submit offer/ proposal for the same. Any queries can be addressed to BEML before submission of offer. Once the offer is submitted to BEML, it is deemed to be understood as inclusive of all deliverables.

9. Submissions

The vendor shall submit the following documents (minimum) along with unpriced technical proposal:

- CBC
- Technical details, specifications & functional capability of the proposed equipment
- Box contents clearly specifying the accessories and included parts
- Company presentation
- Brochure
- Supply experience in India and abroad (as the case may be) along with customer name and year of supply
- Commitment for supply of spares for at least 10 years
- Commitment for technical support during warranty period
- List of spares & consumables applicable for the equipment
- Company certifications and approvals
- Authorization letter from OEM (for authorized distributor)