Department of Materials Engineering
Indian Institute of Science (IISc), Bangalore, INDIA

Local Tender Notice

Tender Notification Ref No.: MT/ENQ-TNDR/VJ/24-25/03 Date: 20th December 2024

The Department of Materials Engineering Indian Institute of Science, Bangalore, invites tenders for supply of "**High Temperature Mechanical Testing System Capable of Testing Samples up to 2000 °C with details as listed below."**

This Invitation for bids is open to all domestic (India based) manufacturers, Indian OEM or its authorized Indian distributors only.

General Specifications for High Temperature Mechanical Testing System

The mechanical testing system is designed for performing mechanical tests on materials at elevated temperatures, specifically up to 2000 °C or more, supporting research in strategic areas. We float the tender seeking interests from the local vendors (i.e., it is not a global tender).

1. Testing Standards and Specimen Geometry

- **Tensile Test**: Specimen geometry and system stability follow guidelines similar to ASTM C1359, typically used for ceramic matrix composites at high temperatures.
- **Compression Test**: Specimen preparation and system stability adhere to standards akin to ASTM C1358 for compressive properties of high-temperature materials.
- **Bend Test**: Specimen geometry and procedures align with guidelines inspired by ASTM C1341 for determining flexural properties of ceramics or composites.
- **Fracture and crack growth tests**: Specimen geometry and system stability as per ASTM E647 and ASTM 1820.

2. System Overview

- **Load Frame**:
  - ✓ A 50 kN servo-electric test system designed for both tensile, compression and low cycle fatigue tests, suitable for a wide range of materials, including metals, ceramics, and composites.

- ✓ The machine should be capable of performing tests under constant displacement rate, constant load rate, constant load conditions and cyclic loading conditions.
- ✓ Total stroke of actuator should be 150 mm or more in air and 40 mm or more in vacuum. Actuator stroke resolution should be better than 0.1 μm.
- ✓ The load resolution should be 0.02% or better of the full scale (i.e., 10 N or less for 50 kN)
- ✓ The frequency should be 1 Hz or more.

- **Temperature Capability**:
  - ✓ The system uses induction heating with a working temperature of up to 2000°C (or more). The temperature should be actively controlled through feedback.
  - ✓ 1 and 2 % or less at 2000°C over 30 and 40 mm, respectively.
  - ✓ Temperature stability: Within 1 % over 100 hours or more at the maximum temperature of 2000 ^{o}C.
- **Vacuum Chamber**:
  - ✓ A vertically mounted vacuum chamber with optional water cooling.
  - ✓ The chamber should achieve a vacuum level of 1×10^{-4} mbar or better and should be equipped for both vacuum and controlled inert environments.
  - ✓ The vacuum chamber should either be transparent throughout or have viewing ports (2 × 100 mm diameter or equivalent) for digital imaging and optical pyrometry.
  - ✓ Feedthroughs for electrical and temperature measurements (e.g., for crack length measurement using DCPD method, extensometer and thermocouples).

3. Key Components

- **Induction Heater**: The system should include a variable frequency induction heating system with three sets of coils for conducting tensile, compression, and bend tests.
- **Susceptors**: Graphite susceptors should be employed to ensure uniform heating of the specimen, with slots at 90° or 180° positions for strain and temperature measurement. One slot should be designated for strain measurement, while the other should be for temperature measurement.
- **Heating Rate**: The system should achieve heating rates of up to 50°C/s, with programmable load-temperature profiles to offer precise control during testing.
- **Vacuum System**: A combination of a turbo molecular pump and rotary pump should be employed to maintain the high vacuum required for extreme temperature testing, with additional provisions for introducing gases into the test environment if necessary.

- **Temperature Measurement**: A couple of dual-color pyrometry probes should be provided for accurate temperature measurement through the vacuum chamber having 2 points of measurement over the gauge length of 40 mm.
- **Displacement Measurement**: Contact extensometer up to 1500 °C.

4. System Control

- **Software**: The system should be equipped with application software to manage tensile, compression, and flexural tests. It should include real-time data acquisition and customizable report generation.
- **Digital Controller**: A high-resolution digital servo-controller for precise management of actuator movements, loads, and temperature regulation for consistent and repeatable testing results.
- **System Stability**: Temperature, load and displacement rate controllers should allow performing tests up to 2000 °C over 100 hours or more with the aforementioned performance. This will allow performing creep and fatigue experiments for 100 hours or more at 2000 °C.

5. Video Extensometer (*Optional*): For non-contact strain measurements at high temperatures, particularly where traditional extensometers might not perform optimally due to thermal constraints.

- ✓ **Scope**: Focused on achieving accurate strain measurements at temperatures of up to 2000°C, ensuring reliability and repeatability. This should be integrable to the main control system (with high transfer rate, 10GE or better switch).
- ✓ **Features**: High-resolution image capture, storage and compatibility with digital image correlation (DIC) techniques for advanced performance in strain measurement.
- ✓ **Measurement Accuracy**: Following guidelines similar to ASTM E83 for high-temperature applications. Specify the strain resolution over the maximum elongation.

6. Terms and Conditions

- The vendor must have an established track record in manufacturing and supplying high-temperature universal testing machines (HT-UTM), including those equipped with induction heating systems, to various Indian institutions, such as IISc, IITs, NITs and national labs. The vendor must have supplied at least two HT-UTM capable of testing samples at temperatures of 1500 °C or more. The vendor should submit references.

- Pre-dispatch inspection and demonstration of specifications at the vendor’s shopfloor is mandatory.
- List of customers to whom a similar system has been supplied (at least one must be specified)
- Payment terms should indicate milestones of achievement of technical specifications against which pre-despatch payment will be made. Final balance payment amount will be made after meeting the above acceptance standards after installation at site in IISc.
- Charges must be inclusive of delivery, insurance (including shipment damage), installation on site, taxes, spares for 3 years operation and training for 2-3 operators.
- Delivery time should be mentioned/
- List of utility requirements needed from customer on site should be listed

Tender Summary

1.	Tender Number	**MT/ENQ-TNDR/VJ/24-25/03**
2.	Tender Date	**20th December 2024**
3.	Item Description	**High Temperature Mechanical Testing System Capable of Testing Samples up to 2000 °C**
4.	Tender Type	Two bid system: (a)Technical Bid (Part A) (b) Commercial Bid (Part B)
5.	Place of tender submission	The Chair Department of Materials Engineering, Indian Institute of Science, Bengaluru 560012
6.	Last Date & Time for submission of	**10th January 2025, on or before 1700 hrs**

Terms and conditions

1. Two-bid system (separate technical and financial bids) in sealed tenders.
2. The technical bid must clearly specify the prescribed technical specifications without including the prices. Please provide in detail the specifications under each subhead and bullet point. Unique characteristics may be highlighted.
3. Vendors who include price information in the technical bids will be automatically disqualified.
4. Technical bids will be opened first. IISc may seek clarifications after opening of technical bids and may ask vendors to perform some example experiments on the samples given by IISc to demonstrate the promised technical specifications. Vendors may be required to give presentations.
5. There are several items that require detailed information to be provided by the supplier. If information is not provided against any of these items, this will disqualify the supplier.
6. After technical evaluation by a committee, vendors may be asked to re-quote in a specific format to facilitate comparison of prices.
7. Price bids of only technically qualified vendors will be considered.
8. This tender, as per the government of India rules, **has not** obtained Global Tender Enquiry (GTE) -Exemption. Hence, it is limited to the Indian manufactures qualified to

participate in such tenders.

9. The price should be on FOR-IISc Bangalore basis in INR only.
10. IISc also reserves the right to cancel the tender at any time without assigning any reason whatsoever.
11. Indicate delivery period.
12. Order will be placed on lowest bid from technically qualified vendor.
13. The tender documents can be sent at the following address:

The Chair
Department of Materials Engineering
Indian Institute of Science,
Bangalore 560012, Karnataka
(INDIA)
Attn: Prof. Vikram Jayaram

Annexure 2: Eligibility Criteria

Prequalification criteria:

1. The Bidder should belong to either class 1 or class 2 supplier distinguished by their "localcontent" as defined by recent edits to GFR. They should mention clearly which class they belong to in the cover letter.

a) **Class 1 supplier: Goods and services should have local content of equal to or more than50%.**
b) **Class 2 supplier: Goods and services should have local content of equal to or more than20 % and less than 50%.**

2. Purchase preference as defined by the recent edits to GFR (within the "margin of purchasepreference") will be given to Class-1 supplier.

3. MSME can seek exemption to some qualification criteria. IISc follows GFR2017 for suchdetails.

4. The Bidder must not be blacklisted/banned/suspended or have a record of any service-related dispute with any organization in India or elsewhere.

5. Original Invoice, Original Warranty Certificate, Original Test Reports should be produced for all imported items from OEM (Original Equipment Manufacturer) at the time of supplyof the equipments.

6. Details of experienced service engineer including contact detail should be provided in tender document.

7. Bidder shall have to submit audited accounts (Balance sheet profit and loss account) of financial year 2021-22, 2022-23 and 2023-24. Audited statement must be signed and stampedby qualified chartered accounted.

8. Bidder must submit Income Tax return for assessment year – 2021-22, 2022-23 and 2023- 24.

9. Bidder must submit up to date sales tax or GST clearance certificate.