

# **Tender Notification for Procurement of TWO “Creep Testing Machines” at IISc**

**(Last Date of Submission of Tenders: 5:00 PM, 24<sup>th</sup> April 2020)**

Dear Sir/Madam,

In order to accomplish the goals of a Department of Science and Technology, Government of India, funded project, purchase of **TWO INDEPENDENT SINGLE-LEVER ARM CREEP TESTING MACHINES** is planned. The machines will be used for testing round and flat samples of nickel-based superalloys (main focus), stainless steels, ferritic steels and their welds at temperatures ranging from 100 to 1000 °C (sample temperature). Below, the detailed technical specifications of an ideal machine are mentioned.

## **TECHNICAL SPECIFICATIONS**

**Scope of work:** Supply, installation and commissioning of single-lever type creep test machines for testing in air environment in accordance with ASTM E139 testing standard with the following features.

<b>Item</b>	<b>Sub-Item</b>	<b>Specification</b>
<b>Load Frame</b>		
	Capacity	20 kN or more
	Lever ratio	20:1 ( <i>Option: An additional setting of 5:1</i> )
	Load accuracy	±0.5 % or better
	Fulcrum material	High strength tool steel (HSS)
	Load frame material	Stainless steel AISI316 or better, with grease resistant epoxy paint/ coating on top of it
	Spirit level	Mounted on top of lever arm
	Load lever beam leveling device	Automatic
	Over travel trips	Required
	Flooring requirement	Freestanding, with no special foundation
	Vibration isolation	Neoprene waffle pads or better
<b>Motorized draw dead assembly: For maintaining lever horizontality</b>		
	Limit switches	Required to keep draw head assembly within the limits during both manual and automatic operations
	Manual operation	Provision to manually operate the draw head motor electrically to move it up or down. During the test, the draw head motor moves down automatically by the beam-levelling unit.

	Declutching of motor	Provision to declutch the motor assembly from the gear assembly so that the specimen train assembly can be moved up or down manually by a hand wheel.
	Gear drive jack	Precise, anti-rotation worm gear drive jack with at least 100 mm linear travel and powered by a gear reduced high torque motor.
	Coupling	Flexible coupling for stable, no jitter continuous draw head motion
	Proximity Switch	Proximity switch for noncontact sensing of lever arm position. (This provides auto levelling control and prevents damage when the specimen fails.)
<b>Furnace</b>		
	Temperature range	100-1000 °C
	Temperature stability	± 2 °C or better
	Type	Cylindrical, split type with front locking option and hinged mounted to creep fame on rear side
	Zones	3 equal sized zones with independent temperature controllers and separate power supply
	Temperature uniformity	Better than ± 2°C uniformity in the central region of furnace with height of ≥ 200 mm
	Power requirement	230 V AC single phase 50 ± 2 Hz and 220 ±10 Volts.
	Heating element	Kanthal – Al
	Insulation	Self-containing by using low thermal conducting vacuum cast ceramic fiber, without requiring water cooling of outer jacket.
	Outer shell body	Bright stainless-steel sheet of ≥ 1.6 mm thickness. Closures at top and bottom of the furnace should fit snugly around pull bars and reduce the heat loss at these points. Provisions to seal the top and bottom of the furnace by the compressed vacuum cast ceramic fiber insulation.
	Dimensions	Inner Diameter: 90 mm or above Outer Diameter: 250 mm or below Height: 400 mm or above.
	Controller	Automatic PID controller, with provisions to prevent overshooting of temperature Sample temperature should be the master controller
	Temperature indicators	5: 3 for each zone, 1 for the actual sample temperature and 1 extra (e.g., for room temperature, additional sample temperature, etc.: User selected)

<b>Deformation Measurement System</b>		
	Extensometer	Attached to sample; 4-rod type with provision for single elongation measuring instrument.
	Material of extensometer	Nickel base superalloy to work up to 1000 °C over extended period of times
	Type	High Precision, high accuracy LVDT or linear encoder offering long term stability for creep tests running up to 33,000 h
	Accuracy	1 µm or better
	Stability	± 1 µm or better over 24 h under no load
<b>Pull Rods, Universal coupling, Grips, Adapter and Fixtures</b>		
	Pull Rods	Made of nickel-base superalloy grade MAR M 246/247 or equivalent material (such as like IN 718/713) Super alloys having durability of greater than 3 years at full load and at a temperature up to 1000 °C.
	Fixtures	System shall have suitable fixtures to avoid bending and eccentricity
	Material for adapters	As per ASTM specification Made of nickel-base superalloy grade MAR M 246/247 or equivalent material (such as IN718/713) M6, M8 and flat adaptors for flat specimens of 2 mm (one pair of each size per machine).
	Alignment	Pull Rods, universal coupling, grips, adapter and fixtures should provide perfect axial alignment according to the ASTM E 292 standard.
<b>Weights</b>		
	Denominations	150 N, 100 N, 50 N, 25 N, 5 N and 2.5 N
	Material	226 MS or better, with epoxy paint
	Calibration	Certificate required
	Quantity	150 N → 4 Nos; 100 N → 3 Nos; 50 N → 2 Nos; 25 N → 2 Nos; 10 N → 2; 5 N → 2 Nos; 2.5N → 2 Nos
<b>Data Analysis and Storage</b>		
	Type	Computerized data logging system
	Data set	Time, 5 channels for temperature signals, 2 channels for deformation/ strain (to accommodate an additional strain sensor) and 2 channels for load (to accommodate an additional load cell)
	Sampling frequency	User defined: 1 data set per second to 1 data set per hour or more for up to 33,000 h

	Data logging	Throughout the alignment check, manual step loading and test process (including cooling down of furnace at the end of the test)
	Data analysis	Real time calculation of stress, strain and strain rate
	Display	Instantaneous values of temperature, displacement, strain, strain rate, load onto sample, stress and all temperatures should be displaced on computer screen in real time; Stored and analyzed data should be plotted, as per user selected style, as a graph on the screen
	Data export	Provision should be there for easy upload of the data periodically for spread sheet applications
	Backup	Computer should be configured so that data is backed up in an external drive in real time, so that data is not lost in case of computer crash/ power failure
	Computer and accessories	An appropriate computer (with accessories) with i5 or better processor with 2.8 GHz or higher clocking speed, 8 GB or more RAM, MS Windows 10 operating system, 1 TB or larger hard-disk, a 1 TB external hard-disk for data backup (linked), latest network/ ethernet card, 21 inch or larger LED display, minimum 4 USB ports, keyboard, mouse, etc. should be provided.
	Software	Software to perform tasks listed above should be included, with perpetual license. Optional: Free upgrade of software that enhances the testing and data analysis capabilities over next 5 years
<b>Safety</b>		
	Automatic shutdown	There must be a provision to automatically shut off the electrical power to the machine when the specimen breaks
	Switches	The main switch and the other switches for temperature controllers, elevator motors, etc., must be provided with suitable good quality circuit breaker for the safety reasons.
	Fuses	Fuses should be used wherever required and the fuse points shall be easily accessible. A minimum of 10 spare fuses / MCB should be provided
	Power off facility	Provision should be there to put off the power to the

		furnace, in case of overshooting of temperature due to malfunctioning of any of the temperature controllers.
	Power failure	Tests should automatically resume upon power resumption
	UPS	APC make or better to continue powering up the sensors and computers for a minimum of 30 minutes. Data protection is essential.
	Calibration	Calibration certificate for all digital and non-digital instruments and probes to be used: <ul style="list-style-type: none"> <li>○ Load measuring system: ASTM E4 and E74</li> <li>○ Extensometer: ASTM E83</li> <li>○ Thermocouples: ASTM E 220</li> </ul>
<b>Training and user manual</b>		
	Training	3 PhD and 3 Masters students needs to be trained during the time of installation and commissioning (i.e., at Indian Institute of Science, Bangalore)
	User manual and certificates	1 hard copy and 1 soft copy in a CD/DVS/USB of the detailed user manual, complete with circuit diagrams (mechanical, electronic and electrical), operational features, calibration certificates.
	Installation files	Installation DVDs/USB for the PC and the software shall be supplied along with the equipment.
<b>Warranty and post-supply services</b>		
	Warranty	18 months from the date of supply or 12 months after installation and commissioning, whichever is later. Extension of warranty period shall be applicable if the downtime of the machine is more than 30 days.
	AMC	3 years following expiry of warranty
	Services	The supplier should have an office or an associate (agent) in India to provide after sales service, support and maintenance.
<b>Acceptability criterion</b>		
	Pre-dispatch inspection	Based on mutually agreed testing plan, on-site testing on samples provides by IISc and qualification will be done before the equipment is made ready for shipping. Data should be shared with IISc and approval should be obtained before shipping. Supplier should furnish the compositional analysis of pull rods, fixtures, adapters, grips and couplers before

		shipping
	Acceptance	The supplier has to demonstrate all the functions of the system according to the specifications after successful commissioning at IISc
<b>Supply of Spares (Optional)</b>		
	Load train assembly	1 set of load train assembly (Pull rods, Universal coupling, Grips, Adapter and Fixtures)
	Rod Type Extensometer	1 set

## 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. At least 3 independent reference letters from India should be provided. IISc may contact more users for obtaining independent references. The committee will have right to reject a bid based on reference letters.
5. The financial turnover of the equipment manufacturer in the previous financial year should be more than or equal to 10 times the total order value. The bidder shall furnish specific details of the company performance.
6. 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.
7. 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.
8. After technical evaluation by a committee, vendors may be asked to re-quote in a specific format to facilitate comparison of prices.
9. Price bids of only technically qualified vendors will be considered.
10. The price bids must offer CIF Bangalore prices.
11. Prices to be quoted separately for baseline system and options. Prices should be quoted in adequate detail with relation to packing details to cover insurance compensation in case of damage to any specific modules
12. Indicate separately price of spares listed above in terms of unit cost. The price of these spares will be included in the price comparison. Any additional spares recommended by

the company will be considered for ordering but not included in the comparison. The buyer reserves the right to make the final decision on ordered spares.

13. IISc also reserves the right to cancel the tender at any time without assigning any reason whatsoever.

14. Indicate delivery period

15. Order will be placed on lowest bid from technically qualified vendor

16. The tender documents can be sent at the following address:

The Chairman

Interdisciplinary Center for Energy Research (ICER)

Indian Institute of Science, Bangalore 560012

Karnataka (INDIA)

Attn: Professor Praveen Kumar