

## TECHNICAL SPECIFICATIONS FOR CREEP FATIGUE TEST MACHINE

A purchase of ONE 50KN SERVO-ELECTRIC CREEP FATIGUE TEST SYSTEM is planned. The machine will be utilized for testing and evaluating room-temperature creep fatigue properties of various materials of interest. The machine should also be capable of doing the creep fatigue tests **with an option of automatic change of load during the test (*in-situ*)**. This is to evaluate the creep fatigue response of the material at different changing loads during the test. Below, the detailed technical specifications for an ideal machine are mentioned.

### TECHNICAL SPECIFICATIONS

**Scope of work:** Supply, installation, and commissioning of 50KN SERVO-ELECTRIC CREEP FATIGUE TEST SYSTEM for testing in air environment in accordance with ASTM E-606 testing standard with the following features.

S. No.	<b>50kN Servo Electric Creep Fatigue Test System specification</b>	
<b>1</b>	<b>Introduction</b>	<p>A computer-controlled 100kN Servo Electric Fatigue Testing System under strain, load, and stroke control mode. The test system including two column load frame, electromechanical actuator, digital controller, computer control and data acquisition system. The system is capable of conducting test at triangular, trapezoidal and sine wave form under strain or load control according to user.</p> <p><b>SCOPE OF SUPPLY:</b></p> <ul style="list-style-type: none"> <li>• 100kN Servo Electric Fatigue system consist of Ø Free standing 100kN two column load frame.</li> <li>• 50kN Servo Electric actuator (Upgradeable to 100kN).</li> <li>• 50kN Dynamic Loadcell.</li> <li>• Hydraulic power unit for grip controls and crosshead movement.</li> <li>• Digital electronic controller for controlling the test condition.</li> <li>• Test builder software for controlling the test parameters at strain, load, and stroke control mode.</li> <li>• Room Temperature LCF grips.</li> <li>• Room Temperature Axial Extensometers.</li> <li>• LCF application software in accordance with ASTM E-606 standard.</li> <li>• Host computer system.</li> </ul>
<b>2</b>	<b>Load frame</b>	<ul style="list-style-type: none"> <li>• ±100 kN capacity hard chrome plated two column load frame with a moveable top crosshead with a provision to mount a load cell on it and a fixed bottom crosshead with a provision to mount an actuator on it</li> <li>• Column spacing: 600 mm</li> <li>• Vertical daylight: 1500 mm (between crossheads)</li> <li>• Column diameter: 65 mm</li> <li>• Load frames are of self-reacting, weather resistant and free from self-induced shocks and vibrations.</li> <li>• Load frames aligned to high precision and have adequate factor of safety and high stiffness (600 MN/m)</li> <li>• Load frame is fitted with lifts for automatic crosshead movement and</li> </ul>

		<p>clamps for locking crosshead.</p> <ul style="list-style-type: none"> <li>• Touch screen operator control panel facilitates major control operations of the machine along with display of Load and Stroke Values.</li> <li>• Emergency stop button mounted on load frame to shut off the system in the event of any emergency.</li> <li>• Distinct frame design makes it work with no extra foundation. The load frame is mounted on Rubber dampers.</li> <li>• Ergonomic hydraulic piping and electrical cabling for uncluttered access to test job.</li> </ul>
<b>3</b>	<b>Servo Electric Actuator</b>	<ul style="list-style-type: none"> <li>• ±50 kN fatigue rated, high performance servo-electric actuator with digital encoder for position measurement</li> <li>• Resolution of stroke measurement: 0.1 µm</li> <li>• Accuracy of stroke measurement: ± 0.5% of read out value</li> <li>• Total stroke: 150 mm</li> <li>• Speed range: 0.1 µm/sec to 5 mm/sec</li> <li>• Threading for inter-connection with load train: M27x2</li> <li>• High performance servo motor and servo drive for precise actuator movement and control.</li> <li>• Note: Electronically Upgradeable to 100kN</li> </ul>
<b>4</b>	<b>Loadcell</b>	<ul style="list-style-type: none"> <li>• ±50 kN dynamic capacity load cell.</li> <li>• Overload capacity: 150% of read capacity.</li> <li>• Precision machined column type design for protection against side load and high stiffness.</li> <li>• 350 Ohm precision transducer class strain gauges.</li> <li>• Non-linearity: ±0.05% of full scale</li> <li>• Accuracy: ISO7500-1 Class 0.5</li> <li>• Resolution :0.02% of Full-Scale Reading.</li> <li>• Fatigue life: 10<sup>9</sup> full stress reversed cycles at loadcell capacity</li> </ul>
<b>5</b>	<b>Hydraulic Power Pack</b>	<ul style="list-style-type: none"> <li>• Contamination insensitive servo-hydraulic power pack of 4 lpm flow</li> <li>• Operating pressure: up to 210 bar, 1.5 kW system operating on three phase AC supply.</li> <li>• Variable frequency drive BiSS control hardware to achieve required combination of flow and pressure from hydraulic power pack.</li> <li>• Gear pump (Bosch)</li> <li>• Relief valve to limit system pressure from zero to 210 bar.</li> <li>• Safety interlocks to trip power pack against temperature overshoot, lower oil level, filter clogging, phase failure and motor overload.</li> <li>• Remote or local power pack operation.</li> <li>• 10 microns return line filter with electric interlocks. Pressure transducer for power pack pressure sense and temperature sensor.</li> </ul>

6	<b>Single Station Digital Servo Controller</b>	<ul style="list-style-type: none"> <li>• High performance Digital Signal Processor with</li> <li>• Resolution of Data Acquisition 24 bit analog, 32 bits digital.</li> <li>• Servo Loop Control: 40 Bits at 6 kHz.</li> <li>• Three stage data filtering, oversampling and user selectable digital filters.</li> <li>• Control Channels - 2.</li> <li>• Configured channels:</li> <li>• Encoder Channel - 2 No's</li> <li>• Load/Strain Channels - 3 No's Ø High Level cards - 4 No's</li> <li>• Digital to Analog Cards - 2No's.</li> <li>• Digital I/O - 8 No's.</li> <li>• PLC/PLI cards for the pump controls.</li> <li>• MTL 32 Firmware for actuator.</li> <li>• MTL 32 Basic software for actuator</li> </ul>
7	<b>Operator Panel</b>	<ul style="list-style-type: none"> <li>• Tablet based control panel with provision to move the actuator.</li> <li>• Thumb wheel for actuator fine movement.</li> <li>• Display oil temperature, working pressure and number of working hours.</li> <li>• Mounted on column of the system and swivel joint to adjust the tablet based on operator convenient.</li> <li>• Emergency shut down button at the convenient position.</li> </ul>
8	<b>Enclosure</b>	Enclosure to house controller and PC without air conditioner. The enclosure is on wheels for easy relocation.
9	<b>External Cables</b>	Electrical cables for servo valve, encoder, load cell and powerpack control each 5m long between load frame and controller and powerpack.
10	<b>Data Analysis</b>	<ul style="list-style-type: none"> <li>• Performs cyclic, static, multi-Step waveform testing.</li> <li>• Test can be done in stroke, load, and extensometer control modes.</li> <li>• Single and multi-channel applications</li> <li>• Display meters for current readouts, maximum and minimum readouts, peak valley readouts, set point and cycle counters.</li> <li>• Data recording collects time and/or peak-valley data to binary formats. Data is exported to MS</li> <li>• Excel/text format where report generation and graphing can be performed.</li> <li>• Data reduction options are available in when logging data in real time or during export of data.</li> <li>• Report Generator:</li> <li>• Data playback</li> <li>• Calculations for cyclic tests: amplitude, area under curve, phase angle, stiffness, modulus, etc.</li> <li>• Report template in excel format</li> </ul>
11	<b>Hydraulic Low Cycle Fatigue Grips</b>	<ul style="list-style-type: none"> <li>• ±50kN self-aligning hydraulic grips</li> <li>• Mounting cups for -</li> <li>• 11L-01: M8 threaded specimens</li> <li>• 11L-02: M10 threaded specimens</li> <li>• 11L-03: M12 threaded specimens</li> <li>• Fatigue rated, zero backlash, light weight and easily mountable without special tool</li> </ul> <p>In accordance with ASTM E606 Rated for room temperature operation</p> <ul style="list-style-type: none"> <li>• M27 X 2 Threaded adaptors</li> </ul>

12	<b>Room Temperature Extensometer</b>	<ul style="list-style-type: none"> <li>• Gage length: 12.5 mm</li> <li>• Measuring range: <math>\pm 1</math> mm</li> <li>• Accuracy: <math>\pm 0.5\%</math> of read out value as per ASTM E83</li> <li>• Resolution: 0.02% of full-scale range</li> <li>• Excitation: 5 to 10 VDC</li> <li>• Sensitivity: 2 to 4 mv/V</li> <li>• Full bridge, 350 ohms strain gauged design</li> <li>• These extensometers are designed for testing wide range of materials including metals, composites, ceramics, and plastics</li> <li>• These will work in both tension and compression, the dual flexure design makes them very rugged and insensitive for vibrations, which permits higher frequency (from 0.01 Hz to 2 Hz) operation</li> <li>• Supplied with standard quick attach kit, for easy mounting on the specimen</li> </ul> <p>Ø Mechanical over travel limits in both direction</p>
13	<b>LCF and CFI testing application software as per ASTM standards</b>	<ul style="list-style-type: none"> <li>• Software to perform LCF and CFI Tests under MTL32 environment.</li> <li>• The user interface contains specimen description, loading parameters, pump controls, test run/stop, graph display, numeric readouts of multiple relevant test parameters.</li> <li>• Tests can be done in stress control, total strain control, plastic strain control, hold time test in both strain and mixed mode control</li> <li>• Option for multi-step programming</li> <li>• Online display of unloading modulus, ratio of unloading and loading modulus, <math>K'</math>, <math>n'</math> yield stress, plastic strain, max-min stress and strain.</li> <li>• Limit settings on Position, load, and extensometer</li> <li>• Option for specimen and furnace temperature data logging</li> <li>• Test termination conditions: % change in modulus, % change in stress amplitude, % change in peak stress</li> <li>• Auto data acquisition settings.</li> <li>• Online graphs of stress vs strain and transients. up to 8 digital sense interlocks</li> <li>Ø Offline post processing program to analyze the results in MS Excel.</li> <li>• Option to save the test profiles.</li> <li>• Option to remove residual strain.</li> <li>• Option to add strain to gage length.</li> </ul>
14	<b>COMPUTER AND PRINTER</b>	<p>Desktop PC with Intel i7 or higher Processor as per the following specifications:</p> <ul style="list-style-type: none"> <li>• Processor: Intel Core i7-3770 3.4G 8M HD 4000 CPU or higher</li> <li>• Chipset/Motherboard: Compatible Intel Chipset/Motherboard</li> <li>• Memory: 4 GB DDR3-1600 DIMM (2x4GB) RAM</li> <li>• HDD: 1 TB 7200 RPM 3.5-inch HDD</li> <li>• Input devices: USB Standard Keyboard, USB Optical Mouse</li> <li>• Compatible Speakers &amp; Headphone</li> <li>• Optical Drives: Removable CD/DVD Writer</li> <li>• Monitor: Compatible 24" digital LED Monitor</li> <li>• Operating System: Windows 8.1 Pro 64 or latest, down gradable to Win7 Pro 64. The original DVD media shall be supplied along with the installation keys.</li> <li>• I/P Rating: AC Single Phase 230V/50 Hz.</li> <li>• All the necessary cables shall be supplied 3000 VA UPS for PC and controller</li> </ul>

15	<b>Other important items</b>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• AMC for 3 years following expiry of warrantee</li> <li>• The supplier should have an office or an associate (agent) in India to provide after sales service, support, and maintenance.</li> <li>• Cost of equipment shall be quoted with price break up details for individual assembly's (a, b, c etc.,)</li> <li>• 2 to 3 research students need to be trained during the time of installation and commissioning</li> <li>• 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. A Hard copy of the manual also to be provided.</li> <li>• Installation DVDs/USB for the PC and the software shall be supplied along with the equipment.</li> <li>• Delivery period/ duration for Fatigue testing system is 4 months.</li> <li>• Vendors/ Bidders should have minimum 10 years of prior experience in the field and should have supplied at least 5 testing system to Educational/ R&amp;D labs in India in the past/ within house testing and servicing facilities/ should be an OEM / installation certificates / po copy of earlier supplies</li> <li>• Data shall be called for along with the bid.</li> <li>• Based on mutually agreed testing plan, on-site testing on samples provided 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.</li> </ul>
16	<b>Pre-dispatch inspection</b>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Supplier should furnish the compositional analysis of pull rods, fixtures, adapters, grips and couplers before shipping</li> </ul>
17	<b>Acceptance</b>	<ul style="list-style-type: none"> <li>• The supplier must demonstrate all the functions of the system according to the specifications after successful commissioning at IISc</li> </ul>

## 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. The quote should come only from Indian Original Equipment Manufacturer (OEM) or their Indian authorized distributor.
5. The quotations should be on FOR-IISc Bangalore basis in INR only.
6. **The Vendors must have supplied at least 5 testing systems to centrally funded technical institutes (IISc, IITs and NITs) and national research labs (DAE, DRDO, DMRL, NAL, NML and equivalent) in the last 5 years. A detailed list of users, along with contact information of primary users, should be provided.**
7. **At least 3 independent reference letters from India (from institutions mentioned in point 4) should be provided at time of submission of tender (as part of technical bid). IISc may contact more users for obtaining independent references. The committee will have right to reject a bid based on reference letters.**
8. 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.
9. **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.**
10. 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.
11. After technical evaluation by a committee, vendors may be asked to re-quote in a specific format to facilitate comparison of prices.
12. Price bids of only technically qualified vendors will be considered.
13. **Prices to be quoted separately for the system with mandatory requirements and the optional items. Prices should be quoted in adequate detail with relation to packing details to cover insurance compensation in case of damage to any specific modules.**
14. 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.
15. IISc also reserves the right to cancel the tender at any time without assigning any reason whatsoever.
16. Indicate delivery period.
17. Order will be placed on lowest bid from technically qualified vendor
18. The tender documents can be sent at the following address by 28<sup>th</sup> November 2021:

The Chairman  
Department of Materials Engineering  
Indian Institute of Science, Bangalore 560012  
Karnataka  
India