Tender Notification for the procurement of **Hydraulic Fatigue Testing Machine** at IISc *(Last Date for submission of tenders: 30th December 2019)*

Dear Sir/Madam,

Kindly send your best quotation for the following item on C.I.P. Bangalore basis. Your quotation should reach us, duly signed on or before 1700 hours 30th December 2019.

Please enclose a compliance certificate along with the technical bid.
Technical specification for 25 kN Servo Hydraulic Fatigue Testing Machine Capable of performing both low and high cycle fatigue tests.

S. No	Name of items	Specification of items (Attach Separate Sheet if required)	Qty	Approx. Cost (in INR)
1.	Load Frame	1.1. Frame rated for at least 25kN in tension / Compression. 1.2. Minimum stiffness better than 50kN/mm, precision aligned load frame with fixed lower platen and adjustable upper crosshead. 1.3. The minimum column clearance required is 400mm and the maximum vertical daylight is 700mm. 1.4. System should be rated for indefinite operations		
2.	Fatigue rated actuator assembly & 25 kN dynamic capacity load cell	2.1. Linear dynamic/static capacity: ±25kN 2.2. Minimum Stroke length: ± 25mm with resolution of 0.1μm 2.3. Shall include anti-rotation assembly 2.4. Servo valves of suitable rating and accumulators of suitable capacity. **For 25 kN dynamic capacity load cell** 2.5 Overload capacity:150% of read capacity or higher 3.2. Non-linearity: ±0.3% of full scale or better 3.3. Accuracy: ISO7500-1 Class 0.5 or better 3.4. Resolution: 0.02% of Full Scale Reading or better.		
3.	Hydraulic power pack	3.1. Hydraulic power pack of sufficient capacity to run the system continuously has to be provided. 3.2. Proper size of accumulators has to be incorporated to avoid jerks/pressure transients in the event of power failure. 3.3. All safety provisions, pressure indicators, temperature indicators, relays have to be incorporated. 3.4. Hydraulic oil of sufficient quantity for the first time filling for the use of hydraulic power pack has to be provided. 3.5. Maximum working noise of 65 dB 3.6. Power pack shall be compact (an integrated power pack is preferable). 3.7. System should be self-cooled. 3.8. It should run on single phase 220V power supply.		

		3.9.	Requires no site preparation		
4.	Digital servo controller	4.1.	1 channel of digital p-encoder input, expandable to 2 channels		
		4.2.	Up to 8 channels of conditioned analog inputs with suitable signal conditioners		
		4.2.1.	1 channel of load cell input		
		4.2.2.	1 channel of strain-bridge for [extensometer input Fatigue Test or extensometer input (Tensile Test) or crack- opening displacement gage]		
		4.2.3.	4 Spare Channels		
		4.3.	1 channel of digital servo-control with loop update frequency of at least 5 kHz		
		4.4.	Synchronized data acquisition into host computer at 5 kHz from up to:		
		4.4.1.	2 channels of 32-bit digital encoder readouts		
		4.4.2.	8 channels of 24-bit analog feedback readouts		
		4.4.3.	1 channel of Set Point		
		4.4.4.	1 channels servo-output for monitoring purposes		
		4.4.5.	8-bits of digital I/O status for pump interface and test status.		
		4.5.	User settable software safety limit interlocks on upper and lower limit readout on each of 2+8 feedback channels with individual option of Stop/Hold/Trip		
		4.6.	Servo control of actuator with user settable/programmable:		
		4.7.	Mode control (Load, Stroke, Strain)		
		4.8.	Real-time automatic adaptive servo-gain adjustment to account for system stiffness variation as a function of specimen stiffness		
		4.9.	Static ramping of Load / displacement/ strain with independently settable ramp rate.		
		4.10.	Cyclic loading with ramp/sine waveform and user settable mean, amplitude and phase at frequency of up to 50 Hz and restricted as per the actuator performance curve, with better than 2% accuracy in loading through adaptive control.		
		4.11.	Provision for multi-step static and cyclic loading, with provision to switch control mode(s) as required.		
		4.12.	User settable error limit on servo-control with option of Stop/Trip		
		4.13.	Host computer (HP/Lenovo/Toshiba/Dell make only)		
		a.	Computer with monitor: 24" Wide Screen Monitor with LED Back Light		
		b.	System block: Intel(R) Core(TM) i7 8th Gen Processor		
		c.	RAM: Min. 8GB Non-ECC DDR3 1600MHz SDRAM Memory		
		d.	Hard drive: Min. 1TB 7200 RPM 3.5" 512e/4k SATA Hard Drive		
		e.	Opti Drive: 8X Max Slimline DVD+/-RW		
		f.	USB Optical Mouse		
		g.	USB Entry Keyboard		

		h. Software: Microsoft Windows 7 Professional operating environment and MS-Office basic edition with Windows 7 or higher version of operating system (Both host computer and application software should provide expansion of system capability including integrated control and data acquisition from other external devices including furnace) 4.14. Additional, easy to use Tablet/Smartphone with WiFi interface to host computer to permit easy stroke positioning by operator during specimen mount/dismount through local access to readouts and device control/status. Tablet mounting with power supply to be provided at convenient location on the machine frame. 4.15. One Hardwired E-Stops, located on the frame for easy access. 4.16. UPS to guarantee safe shut down and unloading in the event of power failure		
5.	Grips and accessories for room temperature applications	**5.1. Universal (Main) Grips:** ±25kN Manually Operated Grips MOC: All grips, attachments for various tests shall be made with EN24.		
6.	Fatigue Test Package	**6.1. Threaded Cups** A set of customized cups that directly integrated with the Universal Grip pull rod to test round specimens with threaded ends of size M8, M10 and M12. **6.2. Axial Extensometer for Fatigue Testing** 6.2.1. Gage length: 12.5±0.01 mm 6.2.2. Measuring range: 0.5/-0.5 mm 6.2.3. Accuracy: ± 0.5% of read out value as per ASTM E83 6.2.4. Linearity: ≤0.15% of full scale measuring range 6.2.5. Excitation: 5 to 10 VDC 6.2.6. Sensitivity: 2 to 4 mv/V 6.2.7. Full bridge, 350 ohms strain gauged design (The extensometers should be designed for testing wide range of materials. The dual flexural design extensometer should be supplied with standard quick attach kit, for easy mounting on the specimen mechanical over travel limits in both directions.) **6.3. Fatigue Testing Software (As per ASTM E606)** The user interface should contain specimen description, loading parameters, pump controls, test run/stop, graph display, numeric readouts of multiple relevant test parameters. Tests should be either possible in stroke or strain control. Tests should be either possible in stress control, total strain control and plastic strain control. Online display of loading modulus, unloading modulus, K', n' yield stress, plastic strain, max-min stress and strain are required.		

		6.3.1. Limit settings on stroke and strain		
		6.3.2. Auto data acquisition settings.		
		6.3.3. Online graphs of stress vs strain and transients.		
		6.3.4. Offline post processing program to analyze the results in MS Excel.		
		6.3.5. Option to save the test profiles.		
		6.3.6. Option to remove residual strain.		
		6.3.7. Option to add strain to gage length.		
		6.3.8. Option to terminate the test at specified modulus drop, stress drop and/or increase in strain.		
7.	Tensile, compression package	**7.1. Wedge Grips (As per E8M)** A set of customized collets that directly integrated with the Universal Grip pull rods to test flat specimens from 0.5 mm to 5 mm in thick and 25 mm wide. **7.2. Compression Platens (As per E9M)** A set of customized platens that directly integrated with the Universal Grip pull rods to test specimens that can be accommodated within the 60 mm diameter of the platen. **7.3. Axial Extensometer for Tensile Test Applications** 7.3.1. Gauge length: 12.5±0.01 mm with suitable adapter for 25 mm 7.3.2. Measuring range: +6.25/-3.1 mm 7.3.3. Accuracy: ± 0.5% of read out value as per ASTM E83 7.3.4. Linearity: ≤0.15% of full scale measuring range 7.3.5. Excitation: 5 to 10 VDC 7.3.6. Sensitivity: 2 to 4 mv/V 7.3.7. Full bridge, 350 ohms strain gauged design The extensometer should be supplied with standard quick attach kit **7.4. Tensile and Compression Testing Software (As per ASTM E8M and ASTM E9M)** Software to perform Tensile and Compression test. The user interface should contain specimen description, loading parameters, pump controls, test run/stop, graph display, numeric readouts of multiple relevant test parameters. 7.4.1. Tests should be possible in stroke or strain control. 7.4.2. Online graphs of stress vs. strain and load vs. displacement. 7.4.3. Option to save the test profiles. 7.4.4. Auto data acquisition settings 7.4.5. Option to view multiple test graphs in one plot. 7.4.6. Option to run test in dual rate. 7.4.7. Option to remove the extensometer and continue the test in stroke. 7.4.8. Option to stop the test after specified percentage load drop. 7.4.9. Limit settings on stroke, strain and load channels. 7.4.10. Offline post processing program to analyse the results in MS Excel.		

8.	Fracture mechanics test package	**8.1. Clevis Grips (ASTM E647)** A set of clevis grips that directly integrated with the Universal Grip pull rods to test specimens with pin holes. These set of clevis grips should be suitable for ¼ C(T) specimen **8.2. COD gauge** 8.2.1. Gauge length: 5±0.01 mm 8.2.2. Measuring range: +3/-1 mm 8.2.3. COD Gage for fracture mechanics studies, in compliance with ASTM 8.2.4. E647 & E1820 8.2.5. High accuracy, full strain gauged bridge construction 8.2.6. Accuracy ± 0.5% of readout value as per ASTM E 83 8.2.7. Sharp grooves as per ASTM E 83 for improved stability 8.2.8. Excitation: 5 to 10 VDC 8.2.9. Sensitivity: 2 to 4 mv/V 8.2.10. Linearity: ≤0.15% of full scale measuring range **8.3. Fracture Toughness Software for K_{IC}, J_{IC} and CTOD Testing (As per ASTM E1820 and E399)** The user interface should contain specimen description, loading parameters, pump controls, test run/stop, graph display, numeric readouts of multiple relevant test parameters. 8.3.1. Tests can be done in stroke or COD control. 8.3.2. Real time graphs of J vs. Δa and load vs. displacement. 8.3.3. Option to save the test profiles. 8.3.4. Auto data acquisition settings 8.3.5. Auto scaling of graph. 8.3.6. Option to see J and Δa value online. 8.3.7. Option to select the previous data file and export the data. 8.3.8. Data file storage in same settings file. 8.3.9. Option to stop the test after specified percentage load drop. 8.3.10. Offline post processing program to analyze the results in MS Excel **8.4. Fatigue Crack Growth Testing Software (As per ASTM E647)** Tests will be done in constant load control, K control, decreasing K control and combination of these with multiple steps. 8.4.1. Option to program multiple steps with different loading conditions and different frequencies. 8.4.2. Online graphs of da/dN, load vs. COD, crack length vs cycles, K vs cycles, etc. 8.4.3. Online display of crack length, Kmax, Kmin, ΔK, Pmax, Pmin, ΔP, da/dN and more Option to stop the test at specified crack length, crack increment, Kmax, cycles etc. 8.4.4. Option to do variable amplitude test using spectrum files like Twist and Falstaff.		

		8.4.5. Option to save the test profiles.		
		8.4.6. Auto data acquisition settings.		
		8.4.7. Auto scaling of graphs.		
		8.4.8. Option to enter material properties and specimen dimensions.		
		8.4.9. Option to measure crack length using remote LLD gage.		
		8.4.10. Offline post processing program to analyze the results in MS Excel.		
		8.5. Three Point Bend Fixture (As per ASTM E399) A set of customized fixtures that directly integrated with the Universal Grip pull rods to test specimens in flexure. It should be able to accommodate specimens within the span range of 30 to 150 mm with roller pins of 5 and 10 mm.		

Terms and Conditions

1. The company should have sold 5 similar-capacity machines to Govt. Funded institutions
2. Two bid system (separate technical and financial bids) in sealed tenders
3. Technical bids will be opened first. IISc may seek clarifications after opening of technical bids. IISc also reserves the right to cancel the tender at any time without assigning any reason whatsoever.
4. Price bids of only technically qualified vendors will be considered and the vendors will be informed the day of opening the price bids.
5. The price bids must offer CIP Bangalore prices.
6. Warranty for 2 years and AMC for the next 3 years (to be quoted) along with parts
7. No end-user certificate will be provided
8. Supply should be within 3 months of placing of order
9. Order will be placed on lowest bid from technically qualified vendor.

➤ The tender documents can be sent at the following address:

Prof. Satyam Suwas
Department of Materials Engineering
Indian Institute of Science,
Bangalore 560012