SERVO-HYDRAULIC Axial Torsional UNIVERSAL TESTING MACHINE (UTM)

The party to provide the following in the quote:

a) The vendor should be an original equipment manufacturer (OEM) with direct presence in India or should be an exclusive agent of an International OEM for minimum 5 years in India. Proof of this relationship should be included along with the technical bid.

b) Attractive discount for an educational institution should be offered

c) Support of hardware and spare for 10 years and more after the End-of-Life of the model.

d) Guarantee and warranty of the product for a minimum of 3 years.

e) To provide details of installed axial torsion systems over the last 10 years of at least 5 users of similar or higher capabilities (specifically combined axial torsion machines) in India (specifically in IIT’s, IISc, NIT’s and reputed national labs like DMRL, NAL etc.) or abroad from reputed institutions/organizations for getting first hand feedback from them about the product and service experience in the technical bid.

f) The price quote should include the cost of 5 year annual maintenance contract (AMC).

g) If the machine failed to meet the specified requirements, the vendor will be held liable to take the machine back at their own cost. IIT Bombay will not be responsible for any damage to the machine until it is handed over to the user

h) The firm should be equipped with well-trained engineers to offer post warranty maintenance and service support. Number of service engineers employed in this region by manufacturer should be mentioned in the technical bid.

i) Details of service support in India that the firm can offer should be given along with the NABL calibration facility

j) Nearest service centre to Mumbai is to be mentioned

k) OEM (original equipment manufacturer) engineer should install not by the agent in India

l) This UTM purchase is subject to the vendor willing to buyback an existing axial testing machine (Make: Instron, Model: 8032) and its accessories. The vendors are requested to inspect the old UTM at the site to evaluate its condition. Machine offered for buy back is on ‘AS IS WHERE IS BASIS’

General Requirement: A servo hydraulic axial torsional system with 100 kN and 1000 Nm capacity that works in close loop with full digital control.
Detailed specifications of the axial torsional system

1. Basic Frame
   a) Precision aligned two column load frame
   b) High Stiffness of load frame (axial and torsional) capable of testing ASTM standard high strength steel and fiber reinforced composites without any compliance effect
   c) The columns should be suitably plated/treated for corrosion resistance
   d) Emergency stop button should be provided on load frame for pressure release. All the cables connecting the load frame, load cell, etc. to the control console should be of adequate length for easy handling

2. Linear Actuator
   a) Capacity atleast 100 kN with verifiable accuracy upto +/-0.5% in the load range of 100 kN to 1 kN with single load cell
   b) Stroke range should be at least +/- 75mm. Accuracy of actuator displacement measurement should be equal or better than +/-0.2% of transducer full travel (vendor to define full travel for their system)
   c) Fatigue rated load cell with dynamic load capacity of +/- 100 kN and the actuator should be fitted complete with LVDT for stroke measurement
   d) Overload protection of load cell for at least 150% of rated capacity without failure
   e) Fatigue cyclic testing capability in the range of 0.1 to 0.3 Hz with atleast +/-75 mm amplitude at 50 kN or higher loads. At higher frequency of 25 Hz at 50 kN or higher loads, the amplitude range should be at least +/-0.5 mm. The difference in displacement amplitude between 0 kN and 90 kN load at 10 Hz should be +/-1.5 mm or less. This capability must be achieved with single servo valve rated at least at 40 lpm or lower.
   f) Load cell should have built-in capability, for example in the form of accelerometer, for inertia compensation

3. Rotary actuator
   a) Fatigue rate load cell with capacity atleast +/- 1000 Nm
   b) Atleast +/- 45 deg rotation in static and +/- 45 deg in dynamic
c) Zero backlash in torque reversal

d) High accuracy alignment coupling to linear actuator

e) ADT angular displacement transducer

f) Overload protection of load cell for at least 150% of rated capacity without failure

g) Fatigue cyclic testing capability in the range of 0.1 to 0.5 Hz with at least +/-45 deg rotation at 900 Nm or higher torque. At higher frequency of 10 Hz at 900 Nm or higher torque, the rotation amplitude should be at least +/-3 deg. This capability must be achieved with a single servo valve rated at 20 lpm or lower.

3. Hydraulic Power Unit (HPU)

a) Digital user interface based protection device for oil temperature, oil pressure, oil level, filter condition, motor temperature etc.

b) High efficiency water cooling system capable of taking water inlet temperatures typical to Mumbai environment

c) Low noise at 75 dB or lower

d) Automatic Interlock

e) Line frequency 50Hz

f) The power pack must be designed to operate at levels of at least 10% above nominal full pressure to compensate for pressure losses in pipes between the HPU and test system

g) HPU should contain pressure compensated variable flow pump configuration with high efficiency motors, operating at greater than 90% efficiency, minimizing electricity consumption

h) The Programmable Logic Controller (PLC) should have the following features: (i) alphanumeric indication of HPU status, operating pressure and oil temperature; (ii) automatic local/remote facility – control reverts to local operation when the controller is disconnected; (iii) extended service functions including flushing and off-line cooling modes; (iv) ability to adjust temperature and pressure limits to suit local conditions

i) Ambient condition: Mumbai weather

j) Hose set for connecting HPU with frame and control cable

4. Grips and Fixtures
5. Axial torsional system capable of conducting the following tests
   
a) Tests: Tension test, compression test, compression-torsion or tension-torsion, flexure test, dynamic test, low cycle fatigue test, high cycle fatigue test

b) Materials to be tested: Metals, Ceramics, Glass or Carbon fibres, Plastics, Elastomers, Wood, Aluminium, Glass, etc.

6. Standards
   
a) UTM must follow one of the standards like ASTM-E4, BS-1610, DIN-51221, ISO-7500 etc.

b) UTM must follow all the applicable standards related to UTM and testing of materials. For e.g.: ASTM E4 -Practices for Force Verification of Testing Machines; ASTM E74 -Practice for Calibration of Force Measuring Instruments for Verifying the Force Indication of Testing Machines; ASTM E83 -Practice for Verification and Classification on Extensometer Systems; ASTM E1012-Practice for Verification of Test Frame and Specimen Alignment under Tensile and Compressive Axial Force Application; ASTM E1856-Standard Guide for Evaluating Computerized Data Acquisition Systems Used to Acquire Data from Universal Testing Machines

7. Hardware
   
a) PC desktop (from reputed vendor) capable of supporting the UTM system software and also interfacing with the UTM controller hardware and having at least Intel i5 or
equivalent processor and at least 8 GB ram, minimum 1 TB hard drive, with CD/DVD read-write drive, USB ports, HDMI port, Ethernet port and wifi capable and 24 inch HD monitor with HDMI cable

b) Should be comprising of dedicated and independent controller box and intelligent interfacing board with high speed, ably supported by A to D and D to A card of high resolution, immunity from and power fluctuation, expandable, universal conditioner, High resolution signal processing, capable of working at room temperature till 40 degree centigrade and 60 to 85% relative humidity, etc.

c) Should include the ability to run static, dynamic/fatigue test in position, load or strain control with or without computer. The system should be controlled by a fully digital, closed loop dedicated system based on 32-bit architecture. Analogue based control systems, even if digitally supervised, are not acceptable.

d) Should also have features like transducer excitation, equal or better than 32bits/64bits waveform generation, data acquisition rates better than 5 kHz, user selectable signal filter, data resolution of 19 bits or better.

e) Where necessary, the controller parameters should be able to be auto-tuned

f) The controller must feature a facility updating the control loop terms in order to compensate changes in specimen stiffness during a cycle

g) The controller should have separate channels for Axial Load, Linear position, Torsional Load and Angular position. Apart from these at least 4 other channels for extra sensor data e.g. strain gages etc. should be provided

h) The controller should be capable of simultaneously handle up to two control loops without affecting its performance

8. Software

a) Software for static and dynamic including fracture tests

b) Basic features like set-up and configuration of display screen and control panel, set-up limits and gain controls, report generation template, live runtime test plots with automatic scaling and zoom in/out, saving and retrieval of test methods and data, example test methods

c) Complete test suite comprising of Tension test, Compression test, Flexure test etc.

d) Easy GUI based steps to create multi step, variable ramp rate loading sequences, single and nested looping of steps.

e) Ability to create different types of loading wave forms like Sine, Cosine, Triangular, Square, Holds, ramps, trapezoidal, user-defined wave forms and sample data visualization.

f) Test methods to be easily and quickly constructed using series of configuration steps within the software
g) Data logging and data reduction tools

h) Ability to visualize real time up to 4 channels of data. Real time graphic display: X-Y, Y-t, Multi-channel, etc.

i) Detailed manuals of software in English along with electronic copies.

j) Extensive data logging: per cycle data (max/min/amplitude/mean level), full hysteresis data, or both combine: at linear, log, change in value or user defined intervals

k) Control of digital and analogue outputs

l) Calculation module for fatigue or durability test viz. Loss Angle, Energy Loss, Tan delta, etc., Elastic Stiffness, Total Energy per Cycle, Young’s Modulus

m) Ability to pause and resume a test; Control of digital and Analogue outputs

n) Data storage to computer disc in ASCII format or any other standard format which is accepted by major data analysis programs.

o) Upgradation of software should be free for first 5 years, which will be compatible to any higher version of windows operating system

9. Safety

a) At all times to ensure test machine operator safety, single mode of control should be enabled i.e. either from the computer or from the test frame. This could be either different control modes like specimen fixturing mode or test run mode etc. Please specify in the technical bid the safety features and capabilities of your controller software and the test machine frame.

10. Integration of hardware plus software

Kindly specify:

a) The time required for installation and commissioning

b) The requirement of civil, electrical, plumbing work etc. to be carried out by IIT for the servo-hydraulic UTM

c) Power requirement

d) Other, if any

11. Training to laboratory personnel after installation and commissioning at IIT Bombay

a) Kindly specify the training period and method of training