Department of Materials Science and Engineering

Date: 05/09/2013
IITK/MSE/UTM-01

     We are interested to purchase one Universal Testing Machine (UTM) of 50kN capacity for carrying out Tension and Compression tests. The proposed machine should comply with or be better than each of the specifications mentioned in the Technical Specifications Section.

     Please carefully note and comply with the following instructions. If any of the instructions are not followed, the submitted bid will be disqualified.

1. Please submit your bids in two separate envelopes named "Technical Bid" and "Price bid". The Technical bid should contain the detailed technical specifications of the proposed machine, photographs of the machine and other accessories offered. The Technical Bid should not contain any prices. The Price Bid should contain the technical specifications as well as prices in details.
2. The "Technical Bid" should contain one "Technical Compliance" statement, each page of which should have signature and seal of the prospective supplier. In this statement, each of the specifications mentioned in the Technical Specification should be re-written and the value (or range wherever applicable) offered in the proposed machine for the given specification should be specifically mentioned. This should be followed by stating whether the offered machine complies or does not comply with the concerned specification. If value offered by proposed machine for any of the asked specification is not specified or comply/does-not-comply for each specification not specified or any ambiguity is left in the specifications, the bid will be disqualified.
3. The prospective supplier should be either original manufacturer or 100% subsidiary or authorized agent of the original manufacturer of the offered machine. The Technical Bid should contain an original certificate obtained from the principal company to this effect.
4. The prospective supplier should have supplied the offered machine to at least 3 government or government-affiliated institutes, which should be either an IIT, IISc, NIT or a national laboratory like NML, NCL etc. The list of such personals having this machine and their contacts should be included in the Technical Bid.
5. Each of the envelopes should be appropriately marked as either "Technical Bid" or "Price Bid". Enclose the two sealed envelops in another bigger sealed envelop and send it to the address mentioned below.
6. The bids should reach the undersigned before 5 pm on **15th September 2013**.

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<h1 align="center">Technical Specifications</h1>

The offered machine should comply with each of the following required specifications:

A. Load-Frame:

1. Universal Testing Machine (UTM) shouldcontain a dual-column load frame with the specifiedstatic load capacity of at least 50kN.

2. The UTM should be capable of performing tests in tension, compression, flexural, shear and reverse stress mode.

3. The operation of the load frame should be controlled accurately and precisely by a DC servomotor with appropriate fast feedback mechanism.

4. For lateral stiffness and robustness purposes, Guidance columns should be provided along with Lead Screws. It should be possible to preload these Lead Screws for elimination of the backlash.

5. The vertical Test Space (distance between the top surface of the base platen to the bottom surface of the moving crosshead) should be at least 1100 mm.

6. In future, the UTM maybe upgraded to perform tests at different ambient conditions using an environmental chamber. The load frame should be designed such that such an environmental chamber from a recognized manufacturer should be easily accommodated in the UTM for being used for testing. Specify all the possibilities and limits of using such an environmental chamber for testing on the offered instrument.

7. To ensure very fast data transmission from the testing system to the controlling computer, an Ethernet interface should be provided between the system and the computer.

8. To ensure safe operation of the machine, the load frame shouldbe equipped with two movable limit switches, each of which should be equipped with a back-up micro switch.

9. Minimum sampling rate of 40,000 Hz should be possible for all channels and 32 bit or better Digital Signal Processor should be used.

B. Load Cells:

1. The system should include two load cells; one of 50kN and another of 100N.

2. Additionally, include one 5kN load cell as an option with cost separately mentioned for this.

3. All the load cells should be rated for 150% static loading of their specified capacity without permanent zero shift and 300% static rating without mechanical failure. It should be possible to zero out the weight of the fixtures up to 50% of the load cell capacity in all the load cells.

4. For automization of calibration, the load cell should be self-identifiable.

5. The load measurement should be done with an accuracy of $\pm 0.5\%$ down to 0.01 of the load cell capacity.

6. The least count of the load cell should be 0.1N or lower for 50kN load cell and 0.1mN or lower for 100N load cell.

7. Linearity should be less than $\pm 0.25\%$ of reading over the rated range of the load cell.

8. Repeatability of 0.25% or better should be possible over the range of the load cell.

9. Residual force after removing forces should not be greater than $\pm 0.05\%$ of the full rate doutput.

10. Temperature compensation should be possible over the range of 0 to 50°C.

C. Extensometers for Strain Measurements:

1. Cilp-on type Strain Gauge Extensometersbe supplied with the system for the gauge lengths of 8mm (travel -50% to +50%), 25mm (travel -10% to +50%) and 50mm (travel -10% to + 100%). Supply separate extensometer for each gauge length. A single extensometer adjustable to all three gauge lengths is not desirable.

2. Two additional channels should be provided for strain measurements using either extensometers or digital image correlation or strain gauges.

3. All of them should comply with the ASTM E83 and ISO 9513 standards and have a capability to measure positive and negative strain values.

4. They should be able to withstand a temperature range of -100°C to +200°C.

5. They must have through-zero strain measurement capability.

6. They must be suitable for closed loop strain control for monotonic and low rate cyclic testing.

7. Inbuilt protection mechanism should be provided to ensure the safety in case of over extension.

8. Repeatability better than 0.1% of the Full Range Output (FRO) should be specified

9. Hysteresis should be better than 0.3% FRO

10. Balance should be better than ±2.5% FRO

11. Sensitivity should be at least 2.5 mv/v

12. Gauge length accuracy should be 0.5% at the specified gauge length.

13. Calibration accuracy should be ±.06% FRO or better

D. Testing Speed:

1. It should be possible to carry out the tension test with the crosshead speed within the range of 0.005 mm/minute to 500 mm per minutes or better.

2. The minimum speed accuracy should be ±0.2%.

E. Software:

1. **Main features**

a) The software must have multi levels of user access based on login name(s) and password(s) to be able to distinguish the user as administrator, expert user, technician, beginner etc.

b) The testing software should be able to perform tensile, compression, flexural, peel, tear, friction and simple and complex cyclic tests and should include an appropriate calculation list for each type of test.

c) Digital displays on the computer monitor should show live load, displacement, and optional strain values in the engineering units that can be selected to be Metric, S.I., U.S. customary etc. Up to 4 live display windows shall be available for simultaneously displaying various parameters.

d) The control software shouldbe capable of setting-up all of the following: test speed, limits on all channels, one step calibration and balance of transducers, specimen dimensions and result tables at a minimum.

e) There should be a provision of at least two result tables and two graphs.

f) To help simultaneous view of several results, provision for extra unlimited number of live displays on display screen of software while test is in progress is a must.

g) The facility for PROFILE CREATION should be possible.

h) The software should allow the user to be prompted during testing and provide a mechanism for the user to select images or video clips to be included in the prompt area when running tests.

i) An option should be provided in software for video recording of a test with replay facility.

j) There should be a provision to copy the graph and result tables from the main test screen to any relevant application like MS Word,MS Excel etc.

k) The main test screen must have a separate window provision for the Real Time Display of the raw data being collected while test is in progress.

l) For detailed view, extensive zooming-in/zoomin-out feature should be available in the graphs.

m) There should be a provision to display at leasttwo Result Tables and two Graphs in the main screen.

n) Facility to program an audio alert is required in software.

o) Feature of addition of a video clip and picture should be available to provide additional guidance to operator.

p) Automatic export of results or reports to an e-mail address, database, printer or a network drive is required in software.

q) The operator should be able to design and generate a customized report.

r) Ability to build own formulae and expressions should be provided.

s) Real Time Calculation in Live displays is required.

2. **Data acquisition**

a) Run time screen must be capable of displaying both the "real time graph" and the "calculated results" of multiple specimens simultaneously.

b) The control software shall be capable of acquiring data at 100 Hz across load, displacementand up to two optional strain channels.

c) A live raw data viewer should be there on the screen while test is in progress.

d) A real time X-Y plot of two selected variables should be displayed

e) Test control software must be able to automatically store raw data or calculated results in an Excel format.

f) The software should offer the facility multiple user inputs:

3. **Data manipulation**

a) The software should have the MS-Word, HTML and PDF reporting formats.

b) The software must include the capability to define correction factors such as machine compliance, slack, pre-tension, load and gauge length.

c) The ability to re-analyze past test data using different calculations must be provided.

d) Replay feature of already conducted tests with altered input parameters should be provided.

e) The software should allow the user to define the company logo as a part of the test procedure and on the report also.

F. Tensile Grips for Metals:

1. The grips should be of 50 kN capacity and based on Wedge Action Principle for easy specimen loading, alignment and positioning.

2. The grips should be rated for the operating temperature range of -70°C to +250°C.

3. Grips should be Suitable for flat and round specimens.

4. Grips should include specimen-centering device to take care of alignment in sideway-plane too.

5. Serrated Jaw Faces should be provided and their specified hardness should be 60 Rc to 65 Rc

G. Tensile Grips for Tapes and Films:

1. 250 N capacity Pneumatic Grips should be provided for testing of tapes, thin films, foils, threads, plastic tapes, fine wires and soft materials

2. Maximum operating Air pressure should be 90 psi

3. Operating temperature range should be at least -25 to +50°C.

4. Facility for local and remote operation should be available.

5. Serrated and Smooth Jaw faces with swivel arrangement in both vertical and horizontal axis.

H. Environmental Conditions:

The offered system should be able to withstand and function properly over the operating temperature range of 10°C to 40°C and humidity range of 10 to 90% non-condensing type.

I. Power Requirements:

The machine should be able to function properly with the standard Indian power supply. The energy consumption should be minimal and desirably less than 700VA without environmental chamber.

J. Safety and Functional Certification:

The UTM should be certified by recognized international standards for safety and for the functionality. The relevant certificates to such effect should be included in the Technical bid.

K. Serviceability and System Status:

1. The supplier should install, commission and calibrate the system and this should be done by a factory trained engineer. Detailed on-site training should be provided after the installation.
2. Factory trained service engineer must be available for additional training or warranty service. A list of service engineers and service centers designated to provide service to IIT Kanpur should be included in the Technical Bid.
3. The supplier should provide the Onsite Calibration of the system up to 50 kN Load with ASTM or ISO standards down to 1/100th of the Load Capacity of the system.