Phone: (0512) 2597582, 2597403 E-mail: head_ce@iitk.ac.in FAX: (0512) 2597395

INDIAN INSTITUTE OF TECHNOLOGY KANPUR
DEPARTMENT OF CIVIL ENGINEERING

PO. IIT KANPUR-208016 (UP), INDIA

Enquiry number: *CE/STR/FIST/2015-16/01*

03 November 2015

Subject: *Supply and installation of the following equipment:*

1. ***2,500 kN servo hydraulic four column loading frame and Controller of Universal Testing Machine (UTM)***
   Note: ***(a)*** *The controller will also be used for operating servo-hydraulic actuators of various capacities(available at IIT Kanpur) for static/cyclic/pseudo-static/dynamic testing and having different types of servo valves (e.g. 2-stage and 3-stage).*
   (b) *The controller software will include the necessary set of tools to allow quasi-static hybrid testing using computer simulation package and communication framework tools (e.g. Berkeley Hybrid Simulation Suite/Open-Sees for quasi-static hybrid simulation with the pseudo-dynamic experimental elements to formulate a complete hybrid simulation environment).*
   (c) *Considering above, the option of buyback replacement of existing controller at IIT Kanpur (Make: MTS Systems Corporation, USA; Model: FTGT; Year of purchase: 2005) will also be considered, provided reasonable buyback price is quoted.*

2. ***600 lpm Hydraulic Power Supply Unit (HPU) by installing 400 lpm HPU which should be able to connect to the existing 237 lpm HPU at IIT Kanpur to get the desired performance required from 600 lpm HPU.*** *Alternatively, 600 lpm HPU should be quoted with reasonable buyback price of existing 237 lpm HPU at IIT Kanpur (Make: MTS Systems Corporation, USA; Model: 506.61E; Year of purchase: 1988).*

With reference to the subject mentioned above, you are invited to submit the quotation in a sealed cover in order to reach us by **26 November 2015** ***(Revised last date of receipt of quotations is: 30 November 2015)*** in the form of a hard copy to the address mentioned below. If you have any questions please call Dr. K.K. Bajpai at 0512-2597859, email: kunwar@iitk.ac.in with copy to head_ce@iitk.ac.in.

The desired technical specifications of the major parts of about equipment are enclosed (please see the Annexure).

The prospective suppliers should be having a ***minimum of 10 years experience*** of manufacturing high force loading frames, servo-hydraulic controllers, and high flow rate hydraulic power units.

The suppliers are required to send quotation in ***two parts in sealed envelopes, as*** "***Technical Bid***" and "***Financial Bid***". The Technical Bid should contain detailed technical specification of the product being offered and should not mention any prices.

The Financial Bid should include the detailed price quotation clearly including the cost of the equipment, packing and installation & commissioning charges, if any.

The cost for imported equipment should be mentioned in foreign currency. The customs clearance/duty etc. charges will be paid by IIT Kanpur against customs duty exemption certificate.

The two separate and sealed envelopes should be clearly marked appropriately as "***Technical Bid***" and "***Financial Bid***". Kindly write the inquiry no on the top of envelop.

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03 November 2015

Terms and Conditions:-

1. Maximum discount that may be applicable to premier educational institute should be offered.
2. Validity of quotation should be at least for **90 days**
3. Prices should be mentioned on both CIF IIT Kanpur and FOB basis separately (for imported equipment)
4. The prices for optional items and buyback price of old controller/HPU (if applicable) should be mentioned separately.
5. The ***Technical Bid*** should contain compliance/deviation from the item wise desired technical specifications, if any for different major parts (please see Annexure for more details about).
6. Financial bid will be open only for those, who meet tender technical specifications.
7. Normal payment terms for the Institute will be applicable (through letter of credit: 90% on delivery/shipment of the items and the remaining 10% after satisfactory installation/inspection).
8. Quotation should carry proper certifications like agency certificate, proprietary certificate, etc.
9. Delivery (FOB) should be made within **06 months** after the receipt of letter of credit.
10. ***Installation& Training:*** *Vendor should provide the complete installation of the system including mechanical, electrical and instrumental parts. The unpacking of system components should be done in the presence of Vendor's engineer and his/her supervision. The training shall be on site after complete installation.*
11. ***Spare Parts and Consumables***: All necessary spares like oil seal kits, filters etc. should be included
12. ***Warranty & Maintenance Program***: 1 year (12 months) after completion of installation works
13. ***Maintenance/trouble shooting/service support***: after warranty
14. ***Performance guarantee***: Performance curves related to the system performance need to be provided. Preliminary and Final acceptance tests will be carried out for the purpose of confirming the required performance of each major unit and sub-units
15. Provision of total system engineering for all mechanical, electrical, hydraulic and software components
16. System checkout, operation and calibration at Vendor's site before shipment.
17. The ***ISO 9001*** series certification
18. For Item number 1, Vendors are required to provide:
    a. Comprehensive list of high force load frame customers in the past 5-10 years. This reference list should include at-least one customer in India with details of support provided e.g. control/ hydraulic power unit integration/equipment rooms layouts and design.
    b. The existing high force testing frame user list should include reference and contact details.
    c. Minimum five end-user statements with signatures and system information for high force application of over 2000 kN.
19. The indenter reserves the right to withhold placement of final order. The right to reject all or any of the quotations and to split up the requirements or relax any or all of the above conditions without assigning any reason is reserved.

Dr. Purnendu Bose
Professor and Head
Department of Civil Engineering
I.I.T. Kanpur PIN 208016

Enclosure: **TECHNICAL SPECIFICATIONS OF MAJOR PARTS OF ITEM NO. (1) AND ITEM NO. (2)**

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ANNEXURE TO ENQUIRY NUMBER CE/STR/FIST/2015-16/01dated 03 November 2015

TECHNICAL SPECIFICATIONS

Item number: 1:: 2,500 kN SERVO HYDRAULIC FOUR COLUMN LOADING FRAME AND CONTROLLER OF UNIVERSAL TESTING MACHINE (UTM)

1.1. LOADING FRAME

1.1.1. Dynamic Force Capacity of 2,500 kN in tension and compression. Dynamic rating shall be based on at least 1,000 million fully reversed loading cycles between +/- 120% of rated capacity.
1.1.2. Test Space Min. 750 mm wide, 500 mm deep, and 3000 m high without test fixtures
1.1.3. Loading Frame Stiffness: $\geq$ 3000 MN/m with column's diameter $\geq$ 150 mm and column stiffening tie bar
1.1.4. Automated cross-head movement/speed/hydraulic lock control with remote control along with hose stand for smooth crosshead lift operation

1.2. ACTUATOR

1.2.1. Cross head mounted +/- 2500 kN Dynamic Force/Fatigue rated actuator
1.2.2. Dynamic stroke of +/- 150 mm (coaxially mounted full stroke LVDT for stroke control and measurement)
1.2.3. Piston rod having internal threads for mounting of grips and load cell
1.2.4. +/- 0.5 mm at ~4 Hz hydraulic performance @ 2000 kN dynamic force using Moog or equivalent three stage servo valve (of suitable flow rate and accumulator)

1.3. LOAD CELL

1.3.1. Fatigue rated at $\geq$ +/- 2,500 kN (0.5 class or better)
1.3.2. Non linearity & Hysteresis $\leq$ 0.2% of full scale
1.3.3. Full range calibration (traceable to NPL/NIST or equivalent)

1.4. HYDRAULIC MANIFOLD (TWO CHANNELS)

1.4.1. Flow rating ~380 lpm or better with accumulators for pressure and return
1.4.2. Capable of preventing damage to specimen due to abnormal hydraulic on/off
1.4.3. There should not be any movement of actuator connected to one channel if the another actuator is being used using second channel
1.4.4. Option of fast unload in case of emergency

1.5. DIGITAL CONTROLLER

1.5.1. Digital control for servo hydraulics, function generation, data acquisition, and analogue & digital I/O
1.5.2. 2 stations, 02 channels (upgradable to 4 stations, 08 channels) with facility to operate individual channels in any arbitrary combination of loading (e.g. Channel 1 is used for applying gravity load on specimen under load control while Channel 2 is used for pseudo-dynamic testing protocol).
1.5.3. Digital Control bandwidth rate:5 kHz or faster

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1.5.4. 32 bit or more microprocessor for creating standard wave forms (including downloaded wave shapes).
1.5.5. Ability for auto zero and restore PID settings
1.5.6. Adaptive controls compensation options including phase control
1.5.7. **50 meter**s Cables for hydraulic control, servo-valves, conditioners, and PC communications (high-speed serial interface only).
1.5.8. Load limited stroke control for specimen protection
1.5.9. Programmable libraries (for use with C++, Visual basic, and National Instrument's Lab View etc.) should be provided for specifically designed for real time control of system.
1.5.10. Capability of switching of control parameters while Hydraulics is On.
1.5.11. Separate handset/panel for servo-hydraulics operations.
1.5.12. Master – Slave PC's for independent station control.
1.5.13. Signal Conditioners for DC/AC transducers and 3-stage servo-valve driver cards (02 sets)
1.5.14. TEDS support: Comply with IEEE 1451.4
1.5.15. 8 channel each for analogue input and analogue output

1.6. CONTROL AND APPLICATION SOFTWARES

1.6.1. User Programmable Software

1.6.1.1. Software interface for configuring the controller and the user interface for test station.
1.6.1.2. Option of on-line data displays (digital and graph) and storage of test data in ASCII/excel formats.
1.6.1.3. System exerciser for setting up tuning parameters
1.6.1.4. Null pacing adaptive control algorithm and adaptive phase and amplitude algorithm for use with ramp/sine wave command
1.6.1.5. Option of performing amplitude control and adjusting the feedback signal phase.
1.6.1.6. Data acquisition options: timed, Peak/Valley, Level Crossing, Cyclic
1.6.1.7. Function generation for Sine, square, triangle, ramp, and ability to play digitized profiles on all channels with availability of Soft start/stop

1.6.2. General Application software

1.6.2.1. The application software will include the ability to control or to capture data from any installed AC or DC transducer, or externally conditioned transducer.
1.6.2.2. The application software shall allow the following kinds of tests to be defined and executed.
1.6.2.2.1. monotonic tests including tensile, compression, and flexure.
1.6.2.2.2. block loading, constant amplitude fatigue and random fatigue using an input file to define end levels and rates.

1.6.3. Hybrid Simulation software

1.6.3.1. To set up and coordinate the integration between the physical and numerical elements of the quasi-static hybrid simulation solution.
1.6.3.2. It should be modular, flexible, and connects the control system to any finite element code (e.g. OpenSees which is ideally suited for quasi-static hybrid simulation with the pseudo-dynamic experimental elements)
1.6.3.3. To allow easy exchange of command/feedback data and utilize a GUI configurater to set-up control channels, feedback signals and engineering unit conversions.

Note : *The option of **buyback replacement of existing controller at IIT Kanpur (Make: MTS Systems Corporation, USA; Model: FTGT; Year of purchase: 2005) will also be considered**, provided reasonable buyback price is quoted.*

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1.7. OPTIONAL ITEMS

1.7.1. HYDRAULIC WEDGE GRIP SET (CAPACITY: +/- 1,000 KN DYNAMIC FORCE)
1.7.2. HYDRAULIC WEDGE GRIP SET (CAPACITY: +/- 2,500 KN DYNAMIC FORCE)
1.7.3. The Hydraulic Wedge Grips should be provided along with standalone hydraulic grip control with wedge sets (Vee/serrated, flat/diamond) suitable for variety of specimen sizes (up to 45 mm dia/ thickness).

Item number: 2

2a. 400 LPM HPU which should be able to connect to the existing 235 lpm HPU at IIT Kanpur to get the desired performance required from 600 lpm HPU.
2b. 600 lpm HPU with reasonable buyback price of existing 237 lpm HPU at IIT Kanpur (Make: MTS Systems Corporation, USA; Model: 506.61E; Year of purchase: 1988).

2.1. HYDRAULIC POWER UNIT 400 LPM (0R 600 LPM WITH OPTION OF BUYBACK OF EXISTING 235 LPM HPU)

2.1.1. Low noise Hydraulic Power Supply (Flow rate: 400/600 lpm at 50 Hz ***upgradable to 600 lpm***) with interlock system for dirty filter, oil level & high temp.
2.1.2. Water cooled with corrosion resistant stainless steel flat plate heat exchangers.
2.1.3. Variable-volume pump
2.1.4. Noise $\leq$ 80 dB with pump operating at high pressure and dumping the full flow over the relief valve
2.1.5. Temperature controlled water saver/shut-off valves
2.1.6. Excellent oil cleaning through absolute 3 micron oil filter
2.1.7. Designed for ambient heat load during peak summer
2.1.8. Advanced PLC for control and monitoring from remote

2.2. HYDRAULIC DISTRIBUTION SYSTEM

2.2.1. Should be able to connect to the existing HPS at IIT Kanpur
2.2.2. Hydraulic Hose stand and Hose sets from Hydraulic Manifold to Hose stand to load frame shall be provided (length: 15 m each).

Note : ***For Item number 2, the quotations may be submitted for items 2a and/or 2b.***