ISO 9001 Organisation
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CSIR-STRUCTURAL ENGINEERING RESEARCH CENTRE
(वैज्ञाभनक तथा औद्योभिक अनुसंधान पररषद Council of Scientific and Industrial Research)
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CORRIGENDUM - I

(REVISED TECHNICAL SPECIFICATIONS)

Sub: Revised Technical Specification - Supply, Installation, Commissioning & Training of 2500kN Servo-Hydraulic Universal Testing Machine.

Ref: 1. CSIR-SERC Tender Ref. No. A3 (72523)2025/PUR/SERC Dt: 17.10.2025
2. CPPP Tender ID: 2025_CSIR_252709_1 Dt: 17.10.2025

Against our CPPP Tender Notice No. A3 (72523)2025/PUR/SERC Dt: 17.10.2025 w.r.t Supply, Installation, Commissioning & Training of 2500kN Servo-Hydraulic Universal Testing Machine and detailed discussion in the pre-bid meeting which was held on 07.11.2025 @ 11.00 AM, the Competent Committee of CSIR-SERC has recommended the following revised Technical Specifications. The pointwise changes to the specifications are highlighted.

Annexure – II

CORRIGENDUM/REVISED SPECIFICATIONS AFTER PBC
(Pre- Bid Conference) on 07.11.2025

(Pointwise Changes to the Specifications of the CSIR-SERC Tender Ref. No. A3 (72523)2025/PUR/SERC Dt: 17.10.2025 for Supply, Installation, Commissioning, Integration and Training of 2500kN servo hydraulic universal testing machine with hydraulic power pack

Page No.	Parameters as notified in the tender SERC	Requirements as notified in the tender	Revised SERC Requirements after PBC
Page No. 52	**Serial No 13.** Hydraulic power pack		Corrosion resistant copper oil to water heat exchanger to dissipate all heat generated by the power unit. Heat exchanger must be designed for cooling water inlet at 25 Deg. C.
Page No. 46	**Serial No. 01** Dynamic Force Capacity and Stroke length	Is the static rating more than 110% of the dynamic rating ? MTS query: static capacity of our frame is limited to capacity of 100% of dynamic rating 2500kN. If we need to comply with the 110% desired specifications, we need to quote 5000kN load frame	The static force rating shall be greater than or equal to the dynamic force rating capacity of ±2500 kN.
Page No. 54	**Serial No. 19** Acceptance test	19.2 Concrete Cylinder Testing (Stress-strain): Demonstration of compression test on concrete cylindrical specimens mounted with a dual averaging extensometer and circumferential extensometer. The test should be strain-controlled, showcasing its ability to capture the full stress-strain behaviour of concrete cylinders, including post-peak response.	Concrete Cylinder Testing (Stress-strain): Demonstration of compression test on concrete cylindrical specimens (150x300mm) mounted with a dual averaging extensometer and circumferential extensometer. The test should be strain-controlled (using an axial extensometer and a circumferential extensometer), showcasing its ability to capture the full stress-strain behaviour of concrete cylinders, including the post-peak response.

Page No. 45	**Chapter IV 4.1**	5. Minimum two (2) Purchase Orders (PO) copies of similar equipment should be submitted. The PO copies shall be from the CSIR Laboratories or other Govt. Institutes/ Organizations or Private Organizations.	Minimum two (2) Purchase Orders (PO) copies of similar equipment with ± 2500 kN or higher capacity to be submitted. The PO copies shall be from the CSIR Laboratories or other Govt. Institutes / Organizations or Private Organizations. Please note that the PO copies to be submitted are of the equipment which are in working conditions on the date of submission of bid.
Page No. 92	**Annexure- XIV- Integrity Pact**	Integrity Pact should be signed by the Bidder/Contractor as per Annexure-XIV.	Integrity Pact signed by the principal is enclosed. Please submit this signed Integrity Pact after duly affixing your Signature and seal (Bidder/Contractor & Witness) This may be uploaded in the CPP Portal and Hardcopy should also be submitted.
Page No. 98	**Annexure -XVII** **Undertaking for Technical Demonstration**	Undertaking for Technical Demonstration	Concrete Cylinder Testing (Stress-strain): Demonstration of compression test on concrete cylindrical specimens (150x300mm) mounted with a dual averaging extensometer and circumferential extensometer. The test should be strain-controlled (using an axial extensometer and a circumferential extensometer), showcasing its ability to capture the full stress-strain behaviour of concrete cylinders, including the post-peak response.

Note: Bidders are requested to submit the bid as per the revised specification in Chapter – 4 (Changes are highlighted) and also submit Annexure – VII – Revised Technical Compliance Statement Form/Deviation Statement Form and Integrity Pact which is hosted in CPP Portal and CSIR-SERC website with CPPP Tender Ref. 2025_CSIR_252709_1 and CSIR-SERC Tender Ref.A3(72523)2025/PUR/SERC. All other terms & Conditions of the tender except the above remain unchanged.

Controller of Stores & Purchase
(For and behalf of CSIR-INDIA)

Annexure-III

CHAPTER - 4

ELIGIBILITY CONDITIONS, SPECIFICATIONS AND ALLIED TECHNICAL DETAILS

CHAPTER - 4

ELIGIBILITY CONDITIONS, SPECIFICATIONS AND ALLIED TECHNICAL DETAILS

4.1 Minimum Eligibility Criteria for Participation in Tender

1. Format for Declaration by the Bidder for Code of Integrity & Conflict of Interest (Annexure - II)

2. Format for Affidavit of Self Certification regarding Local Content (Annexure - XIII).
   (The Class-I Local Supplier & Class-II Local Suppliers are required to provide the "Local Content Certificate" from a Statutory Auditor (or) Cost Auditor of the company (in case of company) or from a practicing Cost Accountant (or) practicing Charted Accountant in respect of suppliers other than companies)

3. Integrity Pact should be signed in the Letter Head of the Firm (Annexure – XIV)

4. Self-certification regarding Land Border (Annexure - XV (or) XVI) as applicable

5 Minimum two (2) Purchase Orders (PO) copies of similar equipment with ± 2500kN or higher capacity to be submitted. The PO copies shall be from the CSIR Laboratories or other Govt. Institutes/ Organizations or Private Organizations. Please note that the PO copies to be submitted are of the equipment which are in working conditions on the date of submission of bid.

(Note: Firms not meeting the minimum eligibility conditions will not be considered for technical evaluation.)

4.2 SPECIFICATIONS AND ALLIED TECHNICAL DETAILS

Technical specifications for ± 2500 kN fatigue-rated servo-hydraulic Computer-controlled universal testing machine with controller and hydraulic power pack

Description of technical details	
1. Dynamic Force Capacity and Stroke length	1.1 Dynamic force rating of ±2500 kN (Tension/compression). 1.2 The static force rating shall be greater than or equal to the dynamic force rating capacity of ±2500 kN. 1.3 Actuator stroke should be ±150 mm, total stroke shall be 300mm.
2. Actuator type	2.1 Double-ended, double-acting, equal area, cross-head mounted actuator. 2.2 Piston rod – one-piece, high tensile material with heavy chrome finish or better. 2.3 Low-friction and anti-rotating long-life bearings. 2.4 Fatigue life $\geq 10^9$ cycles or higher under fully reversed cycles. 2.5 The actuator should have safe normal and low flow velocity options. 2.6 The actuator/hydraulic manifold should have a safety mechanism to hold its position in the event of power loss.
3. Load Frame	3.1 Sturdy self-straining, floor-standing and four-column-type frame with solid monolithically integrated T-slotted base plate at the floor of minimum size 800 mm x 1000 mm with minimum of 4 T-slots. 3.2 The maximum vertical test space without hydraulic grips should be ≥ 3000 mm. 3.3 Minimum clearance between side columns shall be 450 mm (side) x 700 mm (front) (i.e. clear width for test space). 3.4 The total height of the test system should not exceed 7000 mm. 3.5 The nominal stiffness of the load frame should be 3×10^9 N/m at 2m from the base of the frame. 3.6 Fatigue life of load frame - $\geq 10^9$ cycles. 3.7 The resonant frequency of the frame should be more than 20Hz. 3.8 Vibration isolation pads should be placed at the base of the load frame to minimise the vibrations during fatigue testing. 3.9 Moveable crosshead with hydraulic lift and lock control shall be provided. 3.10 Upper crosshead safety interlocks has to be integrated with the control system.
4. Servo valves	4.1 Two separate servo valves of low and high flow capacity are to be provided with a manual shut-off valve. 4.2 The low-flow servo valve should have a maximum flow rating of 100 lpm or less. 4.3 The high flow servo valve should have a maximum flow rating of 300 lpm or more. 4.4 Suitable current-driven servo valves are to be provided to meet the following performance requirements. 4.5 **Low flow performance:** 2250 kN load, 0.5 Hz frequency, ± 1.5 mm amplitude and 2250 kN, 1 Hz frequency, ± 0.15 mm amplitude. 4.6 **High flow performance:** 2250 kN load, 0.5 Hz frequency, ± 9 mm amplitude and 2250 kN, 1 Hz frequency, ± 5 mm amplitude. 4.7 Suitable hydraulic service manifold has to be provided. **Performance curves, actuator, power pack and servo**

	valve has to be provided for the stated amplitude and frequencies.
5. Force transducer (load cell) of capacity: **i) 2500 kN – 01 No.** **ii) 250 kN – 01 No.**	**i) Fatigue-rated force transducer (Tension/compression) of capacity ± 2500kN** 5.1 Hermetically sealed fatigue-rated load cell ± 2500kN capacity for both measurement and control. 5.2 The force transducer should be calibrated for 10%, 20%, 50% and 100% ranges of full scale (FS). 5.3 Accuracy class I - 0.5% 5.4 Linearity better than ±0.2% of full scale. 5.5 Hysteresis ≤ ± 0.2% of full scale. 5.6 Nominal output sensitivity at full scale load - 2 mV/V or better. 5.7 Safe overload ± 150% of full scale or better. 5.8 Fatigue life of load cell $\geq 10^9$ under fully reversed cycles.
	ii) Fatigue-rated force transducer (Tension/compression) of capacity ± 250kN 5.9 Hermetically sealed fatigue-rated load cell ± 250kN capacity for both measurement and control. 5.10 Accuracy class I - 0.5% 5.11 Linearity better than ±0.15% of full scale. 5.12 Hysteresis ≤ ± 0.15% of full scale. 5.13 Nominal output sensitivity at full scale load - 2 mV/V or better. 5.14 Safe overload ± 150% of full scale or better. 5.15 Fatigue life load cell $\geq 10^9$ under fully reversed cycles.
	5.16 Both the dynamic load cells should meet the requirements of IS 1828 Part (1), IS 4166 and IS 1608 (ISO 75001/1 Class 0.5, ASTM E4, EN10002 Part 2, JIS (B7721, B7733) and ISO 10002 Part 2). 5.17 Dynamic systems using wedge grips should include ASTM E467-based dynamic calibration for the complete system with grips 5.18 The load output shall be processed through a signal conditioner within the controller to enable closed-loop control and data logging. The conditioned output shall be provided in the range of ±10 V. 5.19 The transducer shall be supplied with a traceable calibration certificate issued by a reputed, accredited laboratory from the country of origin.
6. Displacement measurement	6.1 Actuator stroke to be measured using coaxially mounted internal LVDT. 6.2 An integral displacement transducer (AC-LVDT) of ±150 mm stroke is to be provided. 6.3 Accuracy better than ±0.5% of FS as per ASTM E2309. 6.4 Linearity better than 0.5% of FS displacement. 6.5 Transducer outputs has to be conditioned at the controller for closed-loop control and data logging purpose. The conditioned output should be ± 10 V. 6.6 The transducer shall be supplied with a traceable calibration certificate issued by a reputed, accredited laboratory from the country of origin.

7. Extensometers	7.1 **Axial strain measurement for steel -01 No.** Extensometer travel ± 5 mm. Varying gauge length options- 12.5 mm, 25 mm and 50mm. Suitable for flat and round steel specimens. 7.2 **Axial Strain Measurement for concrete-02 Nos.** Dual Averaging Axial Extensometer for axial strain measurement. Two strains shall be averaged for a more accurate measurement. Extensometer travel is ± 4.00 mm. Strain calibrations for dual averaging measurement: 10% 20%, 50% and 100% of full scale. Varying gauge lengths of 100mm, 150mm, and 200mm shall be provided. 7.3 **Circumferential Strain Measurement for Concrete-1 No.** Circumferential Extensometer of chordal travel length +12.5/-2.5mm for measurement of poisons ratio and to control the testing. This extensometer is typically used with an axial extensometer package to determine Poisson's ratio and to control testing. Minimum diameter of specimen to be measured is 50mm. Circumferential Chain suitable for 100mm and 150mm diameter specimens. Cable length 20 m to be provided from the controller to the load frame and 2 m from the load frame to the specimen for the extensometers. The transducer output shall be conditioned within the controller to facilitate closed-loop control and data logging. The conditioned output shall be provided in the range of ±10 V.
8. Hydraulic Grips	8.1 Hydraulic grips for tension testing of circular rods and flat specimens with a dynamic capacity of +/-1000kN and static capacity of 1200kN or higher, capable of fully reversed fatigue loading. 8.2 The hydraulic grip should be controlled through a stand-alone hydraulic grip control and supply. 8.3 The grip controller should have an adjustable pressure control system to grip and un-grip the test specimen. An independent grip pressure control has to be provided for both upper and lower grip with a separate pressure gage/indicator for both the upper and lower grips. 8.4 Pressure stability variation during gripping should not exceed ± 0.07 MPa. 8.5 The grip unit should contain pressure gauge to monitor the gripping and un-gripping operations. 8.6 Suitable set of spiral washers should be provided to ensure backlash-free and offset-free pre-loading for fatigue loading. 8.7 Hydraulic grip should accommodate flat inserts and Vee wedge inserts. 8.8 Wedge inserts should be provided for round specimens with diameters ranging from 10 mm to 40 mm. 8.9 Wedges should be provided for flat specimens with thicknesses ranging from 0mm to 40mm. 8.10 Rebar wedges to be provided for bar diameters ranging from 10mm to 40mm. 8.11 The firm should have supplied at least 4 units of similar capacity dynamically rated hydraulic grip supply units in India. Details of the clients to whom such hydraulic grip and wedge inserts have been supplied, along with their addresses, contact person, email and telephone numbers, should be submitted with the technical bid. Both the hydraulic grip and

	wedge inserts should be covered under warranty.
9. Compression platen	9.1 Upper and bottom platens of 300 mm diameter for uniform loading of test specimens. 9.2 Spherical seat for upper platen for proper axial loading of the test specimen. 9.3 Compression platen to be made up of hardened alloy steel of hardness R_c 58 or higher. 9.4 Bottom platen to be etched smoothly with concentric rings for centering specimens. 9.5 Suitable mating connectors (studs) should be provided with the system to connect with and without hydraulic grips.
10. Computer-controlled Digital Controller	10.1 The controller must allow tests in load, stroke, and strain control (via internal LVDT or external extensometers). The system should support two independent strain control channels. 10.2 Controller shall support Proportional, Integral, Derivative, and Feed-forward (PIDF) control. 10.3 High-precision digital signal conditioners and valve drivers should be provided for the control signals. 10.4 Controller must allow for any inputs (minimum of four) to be assigned to any control channel by the user without requiring re-arranging controller hardware. 10.5 Control software shall have the ability to automatically recognize added controller hardware (TEDS). 10.6 Controller must have minimum 8 digital input and output (DIO) and 8 analog output of ±10 V should be provided for external data logging and external control mode. 10.7 Controller must have option to control or acquire data up to 5 kHz for at least 8 external analog signals. 10.8 Continuous synchronous data acquisition at user-selectable sampling rate with a maximum of 5 kHz on all internal and external channels. 10.9 Controller shall support channel control mode with the second feedback signal for controlling the actuator for safe specimen installation and removal during testing. It should prevent the actuator from exceeding user-defined limits on either the active or limiting channel. 10.10 Controller shall support Dual Mode control with two feedback signals to provide better control stability. 10.11 The controller must allow for any output channels and input channels to be configured by the user via software, without requiring any controller hardware to be rearranged. 10.12 Controller must be expandable to at least two independent test stations with additional hardware in the same controller. 10.13 Controller must support either 2 or 3 stage valve drivers 10.14 Bumpless switch-over from one control mode to another control mode with and without hydraulics. 10.15 Controller should have adaptive Control System, allowing continuous update of PID terms for specimen stiffness and automatically compensating at a minimum frequency of 1 kHz with auto and manual tuning facility. 10.16 The Controller should adapt for Peak/Valley control, Amplitude/Mean control, Amplitude and Phase control. Control loop update should be 5 kHz or faster. Loop closure rate should not be affected by number of control channels. 10.17 Auto Loop Shaping: Position, Load, and Strain. Multi term control, including PID, lag, feed forward and compensation, with serial, parallel and cascade control. High speed computer interface, using the industry-standard Ethernet/USB. 10.18 Transducer signal conditioners for load, stroke,

	extensometer, COD (crack opening displacement) and external strain sensors to provide high accuracy, low drift and low noise transducer signal with user-selectable standard filters. 10.19 Digital sensor conditioners providing minimum 16 bit data resolution across the complete span of the sensor. Interlocks and indicators are to be provided for transducer excitation failure and conditioner saturation. 10.20 Automatic transducer recognition and calibration to be provided. 10.21 All adjustments on the signal conditioners are to be made by software. 10.22 Programmable limit/event detection for providing rapid intelligent actions or test interruptions. 10.23 User selectable limit/event detector actions such as hydraulic off, indicate, hold, change mode and hold, reset, unload, and no action has to be provided. 10.24 Programmable display meters for providing the user flexibility of programming and the parameters to be displayed on the meters. 10.25 All test templates that support testing against standards can be modified by the user, using the graphic interface (no requirement to change source code). 10.26 All variable definitions and calculations as well as the test flow/sequence and logic are visible and can be changed by the user. 10.27 The user should be able to select any of the following parameters for display cyclic/ramp signal track, mean, amplitude, min., max., peak, valley, current cycle count, total cycle count, segments etc., 10.28 The user should be able to generate as many number of display meters as required to display the above parameters based on the requirement. 10.29 Programmable display scopes for providing the user the flexibility of programming the parameter to be displayed on X and Y axis. The user should be able to select any of the following parameters for the Y axis: load, stroke, COD, extensometer output, external LVDT output, command, servo drive, error etc. The user should be able to select any of the following parameters for the X axis: time, load, stroke, COD and extensometer outputs. User should be able to adjust the scaling and trace time based on the requirement. The scope should have user selectable and auto scaling features. The scope should be able to plot one channel versus another channel. 10.30 Programmable automatic dynamic mode changing to any transducer connected to the machine, which has been selected for control, including load-limited displacement during specimen loading. 10.31 Waveform command generation with 32-bit resolution up to 500 Hz for each sensor, with, sine, triangle, square, haversine, havertriangle, haversquare, ramp, dual ramp, trapezoid in relative and absolute modes and support for digital drive data or an analog input of ±10 V. 10.32 The controller with necessary software should be able to run static and fatigue tests and data acquisition should have the following features: ✓ Selection of wave form type, timed sample, peak / valley, max / min, level-crossing, cyclic / logarithmic and mean/amplitude with ability to tie data channels to a master signal. Starting quadrant, and number of cycles to stop, action

	to be taken at the end of the defined test. ✓ Run, hold, continue, and stop buttons for controlling the test. ✓ Online instantaneous adjustment of frequency, amplitude, and mean of the cyclic waveform tests. ✓ Online visual indication of limit settings and status. ✓ Data acquisition and storage of external and internal signals with a user-adjustable sampling rate. The data acquisition mode in the form of maximum and minimum, level crossing, peak valley, continuous and high speed. ✓ The user should be able to switch on / off hydraulics from the controller. The user should start, pause and stop the test program. ✓ An emergency switch-off button should be provided in the load frame, hydraulic power pack and near the controller. 10.33 The controller shall comply with the requirements of IS/IEC 61010 – Safety requirements for electrical equipment for measurement, control, and laboratory use.
11. Application software package	11.1 The software should be able to carry out the waveform profiles such as sine, triangle, haversine, square, ramp, trapezoid, etc., for conducting basic static and fatigue tests. 11.2 The software must support the following tests: • Random/block profile playback, • High-cycle and crack growth testing • Resume from power failure, • Custom command logic, • Parallel branching and event-based data logging. 11.3 The software packages should have real-time graphic options, formula calculations, and data in the form of ASCII and Excel formats. The software shall be used for generating and executing tests. The software should have the ability to control or capture the data from the internal and external transducers. 11.4 Random\field data\profile playback software for playback of field data obtained from components undergoing service conditions/constant amplitude fatigue. The software should be able to read the profile data file created using a spreadsheet or a text editor. 11.5 The block loading software should be able to continue the block segment when the test system stops due to a power failure or user-defined test termination, and it should resume from the block segment where it was stopped when the user restarts the test system. 11.6 The software should have the capability to change, view, create, edit and create loops in the process variables as per the user commands with ease. 11.7 Software test design to support parallel branches for test execution and logical operators (if/then, while). 11.8 The software should have a feature to allow data to be collected and stored to disk during any simple or complex testing. 11.9 The data acquisition routines shall include time data collection, peak valley, maximum/minimum and level crossing data acquisition and the additional slave channels to be collected simultaneously. All internal conditioned channels can be used as the master or as the slave channel. 11.10 The software shall allow the operator to directly interact with the progress of the test through user-defined software buttons. 11.11 The user should be able to define customised software buttons with names and descriptions that, when clicked with the mouse, cause the test program to sequence to the next desired test sequence.

	11.12 The software shall allow the user to set up command segment end levels that are from a different transducer channel than the channel being used for test control. The end level or data limit can be set up to terminate the current segment when the data limit is approached from below, above or either direction. The data limit can also be used to trigger data acquisitions and other definable test system processes. Data limits can be set up to cause the test system to go to any definable state upon detection. 11.13 The software shall have an event detector watching for changes in peak-valley readings. The process can be used to trigger data collection or other definable test system processes. 11.14 The various display on the computer monitor during testing should be legible, easy to read, including the font size. 11.15 During testing, when the power supply stops suddenly and unexpectedly, the test should stop at the stage of the testing without any damage to the test specimen or test setup. The hydraulics should immediately disengage completely without any application of load to the test system. 11.16 Further, it should be able to resume the same test from that point onwards, where it had stopped. 11.17 Test software to provide standard templates for running tensile tests on rebar specimens. 11.18 Software to have a freely configurable run time view (show an unlimited number of variables, meters, charts and tables). Should show the test flow while the test is proceeding, indicate active vs. finished actions. 11.19 The system should be usable under local conditions, and must be installed and commissioned with no additional costs.
12. Computer	12.1 The supply shall have latest hardware and operating system for interfacing with the digital controller. 12.2 **Computer specifications:** Processor and speed: Intel Core i9, 12th generation Ram:32GB Hard disk (SSD): 1TB OS: Windows-11 or latest at the time of supply. Monitor: 30-inch LED dual monitor 12.3 For technical reasons, if the supplier wishes to offer a computer system with different specifications, then the same should be justified and detailed specifications of the computer system shall be given. It is the responsibility of the quoting firm to ensure complete compatibility between the testing system, test software and the computer system.
13. Hydraulic power pack	13.1 **Total flow capacity of the hydraulic power pack** The minimum total flow capacity of the power pack should be 300 litres per minute. Minimum reservoir capacity shall be 1200 litres, and it should be enough to operate continuously for at least 16 hours under the performance stated in Sl. No.4, considering the capacity of cooling unit. Corrosion resistant copper oil to water heat exchanger to dissipate all heat generated by the power unit. The heat exchanger must be designed for a cooling water inlet at 25 °C. Pumps should be able to support 2 or more test systems.
	13.2 **Operating pressure of the power packs**: 210 bar (3000 psi).
	13.3 **Rated pressure of the power pack component**: Minimum 280 bar (4000 psi)
	13.4 **Type of hydraulic pump for power packs:** The pump and motor should be of a submerged pressure-compensated variable-displacement and variable flow type.

	13.5 **High-pressure and low-pressure oil filtration:** Three-micron high-pressure filter to be provided for system filtration at the outlet of the pump. Ten-micron low-pressure filter shall be provided for system filtration at the inlet of the power pack reservoir
	13.6 **Accumulators:** High-pressure accumulators of suitable capacity are to be provided at the outlets of the pumps to manage surges in flow demand.
	13.7 **Sensors to monitor vital parameters:** Suitable sensors to be provided to monitor rate of oil flow, oil pressure, oil temperature, oil level in the tank, filter block condition, cooling water temperature etc.,
	13.8 **Hydraulic oil:** The first oil fill of the power pack should be filled by the vendor. Mineral-based equivalent to DTE25, servo 46, or Shell Tellus 46 AW (to be supplied), oil required for initial flushing also to be included in the supply.
	13.9 **Operating features:** Touch screen-based Programmable Logic Controller (PLC) of size 6" or above to be provided with the following features for the operation of the power pack: **Remote and Local control of the power pack** • The power pack should be provided with an integral front panel PLC control, and it should be operated remotely through the controller of the UTM located in the control room. **Normal mode operation** • Power pack has to be started in low-pressure mode and then the system pressure needs to be raised to the nominal operating pressure (3000 psi) smoothly **Cooling mode operation** • When the oil temperature exceeds the prescribed limit due to unforeseen circumstances, it should be possible to operate the cooling pump alone and circulate the oil in the heat exchanger at low pressure to bring down the oil temperature. **Flushing mode operation** • In flush mode operation, the power pack should circulate the hydraulic oil at low pressure in the hydraulic circuit for flushing. • The PLC operator control panel should indicate the status of the power pack, such as mode of operation, rate of oil flow, oil pressure, oil temperature, oil level in the tank, oil filter condition, safety interlock conditions, etc., • Manual override option has to be provided for the interlocks, for operating the power pack in normal mode for a short duration.
	13.10 **Safety and interlock features:** The power pack should shut down in the following circumstances • If the oil temperature exceeds, or falls below, the pre-set values • If the oil level in the reservoir tank drops below a minimum level • If the pressure in the system exceeds or falls below the pre-set value • If the motor current or temperature exceeds the pre-set value • Pressure Relief Valve has to be provided as a safety mechanism for preventing the power packs operating at more than the normal operating pressure

	13.11 Electrical supply available for the operation of the power packs: Three phase 400 V ± 6 %, 50 Hz
	13.12 **Acoustic attenuation:** The power packs has to be provided with acoustic attenuation to reduce the noise output from the power pack to less than 70 dB at a distance of 1m.
14. Hydraulic service manifold (HSM)	Independent hydraulic service manifold with on/off low- and high-pressure control shall be provided with the following functions: 14.1 HSM should have smooth, controlled transitions of oil flow to enhance system safety. 14.2 HSM should have a provision to minimise the rapid application and removal of high pressure during abnormal operation. 14.3 HSM to be provided with rapid dump hydraulic pressure unloading features in the event of any abnormal operation or potentially hazardous conditions. 14.4 Suitable pressure accumulators to be provided in the pressure and return line to minimise the effect of pressure fluctuations. 14.5 Slow pre-filling to 75% of nominal pressure for smooth start-up. 14.6 Maximum operating pressure of HSM is 3000 psi. 14.7 Ability to set variable low pressure from about 1 to 20 MPa is required. 14.8 Hydraulic manifold with on/off low- and high-pressure control; software selectable. 14.9 Accumulators of a minimum 4-litre capacity are to be provided for smoothing out pressure fluctuations. 14.10 Pressure line and return line filters of the required size are to be provided for removing any contamination in the oil. Filter interlock should be provided.
15. Flexible hydraulic hoses	15.1 Flexible hoses (pressure, return, and drain/pilot) of required length from the HSM to the hydraulic power pack (to suit the site conditions). 15.2 Flexible hoses (pressure, return, drain/pilot) of required length from HSM to load frame (to suit the site condition).
16. System cables	16.1 System cables of required length (to suit the site condition) from the controller to the UTM. 16.2 System cables of required length (to suit the site condition) from the controller to the HSM.
17. Warranty	17.1 One-year warranty followed by three years AMC. The bid should include three years of AMC after one year of warranty. The AMC charges will be taken for evaluating the bid. 17.2 The commercial quote should include the charges for the above.
18. Installation and commissioning	18.1 The firm should take full responsibility for the supply, installation and commissioning of the equipment. Installation and commissioning should be carried out in CSIR-SERC, and performance of the system should be demonstrated to the satisfaction of the users in CSIR-SERC.
19. Acceptance test	19.1 Acceptance tests shall be conducted on the supplied equipment in India. The vendor's technical bid will be evaluated based on the performance of these tests. Failure to meet any of the acceptance test criteria will result in outright rejection of the technical bid. CSIR-All the tests mentioned below must be successfully demonstrated by the vendor: 19.2 **Concrete Cylinder Testing (Stress-strain):** Demonstration of compression test on concrete cylindrical

	specimens (150x300mm) mounted with a dual averaging extensometer and circumferential extensometer. The test should be strain-controlled (using an axial extensometer and a circumferential extensometer), showcasing its ability to capture the full stress-strain behaviour of concrete cylinders, including the post-peak response. 19.3 **Notched Flexural Beam Testing:** Demonstration of flexure test on notched concrete beam using external LVDT and CMOD gauge for control at loading rate of 0.05 mm/min, to evaluate flexural performance and crack propagation characteristics. 19.4 **Steel Rebar Testing:** Demonstration of cyclic strain-controlled tests on steel reinforcement bars (rebars) using extensometer.
20. Operation and maintenance training.	20.1 Installation and Commissioning The system shall be installed and commissioned at CSIR-SERC by the manufacturer, using trained and experienced service engineers. 20.2 Training Program Upon successful installation, the manufacturer shall provide a 5-day training program at CSIR-SERC. The training shall cover routine operation and maintenance of the UTM, hydraulic power pack, sub-systems, and cooling system. Training materials shall be supplied by the manufacturer. This training shall focus on the procured software, safety features and include demonstrations using actual test specimens During the warranty period, the vendor shall provide hands on support at free of cost, as and when required.
21. Maintenance and service support of the equipment during and after the warranty period.	21.1 The vendor should have a competent and reliable service network in India for quick and necessary repair and maintenance of the equipment. Details of the nature of service support the firm can provide should be given along with the bid. The firm should commit to provide maintenance service and supply necessary spares for the equipment for at least 10 years after successful installation and commissioning. 21.2 The details submitted by the vendor regarding service and maintenance support shall be subject to evaluation by CSIR-SERC.
22. Software, operating system and related hardware	22.1 The vendor should agree to give technical and service support to the test software, operating system and related hardware for a minimum period of 10 years from the date of completion of installation and commissioning.
23. Technical documents and catalogues	23.1 The vendor should enclose all the relevant technical documents and catalogues for all the components included in the quotation.
24. Compliance statement	24.1 Compliance statement, clearly mentioning point-wise compliance, should accompany the main technical offer.
25 Operation and maintenance manuals	25.1 Two sets of operation and maintenance manuals along with all necessary drawings should be supplied along with the testing system. 25.2 Backup pen drive for total firmware, background software and the application software packages should be supplied.

Note: The bidder requested for technical demo of the product quoted after submission of bid for technical evaluation.

4.2.2 General criteria: -

1. List of installations of similar work with contact details should be provided. Performance Statement Form (Annexure VI)

2. The bidder shall furnish documentary evidence to demonstrate that the bidder satisfies the bidders' eligibility criteria.

3. Bidders shall invariably furnish documentary evidence (client's certificate) in support of the satisfactory operation of the similar systems executed by him.

4. Spares and service support for the instrument for the period of 10 years from the date of installation.

5. Details of make, model, service support for the outsourced items/ supporting accessories (Technical details in technical bid)

6. Details of Service Centre and information on service support facilities that would be provided after the warranty period (in the Service Support Form-Annexure IX).

4.3 Scope of Supply

Supply, Installation, Commissioning & Training of 2500kN Servo-Hydraulic Universal Testing Machine

4.4 Inspection & Tests

4.4.1 General

1. The Supplier shall at its own expense and at no cost to the Purchaser carry out all such tests and/or inspections of the Goods and Related Services as are specified here.

2. The inspections and tests may be conducted on the premises of the Supplier or its subcontractor(s), at the point of delivery and/or at the Goods final destination.

3. Whenever the Supplier is ready to carry out any such test and inspection, it shall give a reasonable advance notice, including the place and time, to the Purchaser. The Supplier shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Purchaser or its designated representative to attend the test and/or inspection.

4. Should any inspected or tested Goods fail to conform to the specifications, the Purchaser may reject the goods and the Supplier shall either replace the rejected Goods/software or make alterations necessary to meet specification requirements free of cost to the Purchaser.

5. The Purchaser's right to inspect, test and, where necessary, reject the Goods after the Goods' arrival at final destination shall in no way be limited or waived by reason of the Goods having previously been inspected, tested and passed by the Purchaser or its representative prior to the Goods shipment.

6. The Supplier shall provide the Purchaser with a report of the results of any such test and/or inspection.

7. Before the goods and equipment's are taken over by the Purchaser, the Supplier shall supply operation and maintenance Manuals together with Drawings of the goods and equipment's built. These shall be in such details as will enable the Purchase to operate, maintain, adjust and repair all parts of the works as stated in the specifications.

8. The Manuals, Drawings and Guides shall be in the ruling language (English) and in such form and numbers as stated in the Contract.

9. Unless and otherwise agreed, the goods and equipment shall not be considered to be completed for the purposes of taking over until such Manuals, Drawing and Guides have been supplied to the Purchaser.

10. On successful completion of acceptability test, receipt of deliverables, etc., and after the Purchaser is satisfied with the working of the equipment, the acceptance certificate signed by the Supplier and the representative of the Purchaser will be issued. The date on which such certificate is signed shall be deemed to be the date of successful commissioning of the equipment.

ACCEPTANCE TERMS

11. Specifications should be strictly adhered to without compromise. At the time of supply, all the parts supplied should be the latest one i.e. should there be a new and improved version of the part(s) developed after the quote was furnished the improved versions should only be supplied and without any additional cost to the buyer.

12. A simple step-by-step operating procedure which will be kept near the equipment indicating the precautions for e.g. Safe pressures, dos and don'ts for safe and correct use of the entire equipment including software should be provided to help extend the life of the system.

13. The service manual to be given.

4.4.2 Pre-dispatch Inspection by CSIR-SERC

Not Applicable

4.4.3 Manufacturer's Inspection Certificate

After the goods are manufactured and assembled, inspection and testing of the goods shall be carried out at the supplier's plant by the supplier, prior to shipment to check whether the goods are in conformity with the technical specifications. Manufacturer's test certificate with data sheet shall be issued to this effect and submitted along with the delivery documents. The purchaser reserves the options to be present at the supplier's premises during such inspection and testing.

4.4.4 Third Party Inspection

Not Applicable

4.4.5 Acceptance Test

The acceptance test will be conducted by the Purchaser, their consultant or other such person nominated by the Purchaser at its option after the item is installed at Purchaser's site in the presence of supplier's representatives. The acceptance will involve trouble free operation. There shall not be any additional charges for carrying out acceptance test. No malfunction, partial or complete failure of any part of the item is expected to occur.

The Supplier shall maintain necessary log in respect of result of the test to establish to the entire satisfaction of the Purchaser, the successful completion of the test specified. In the event of the ordered item failing to pass the acceptance test, a period not exceeding two weeks will be given to

rectify the defects and clear the acceptance test, failing which, the Purchaser reserve the right to get the item replaced by the Supplier at no extra cost to the Purchaser.

Successful conduct and conclusion of the acceptance test for the installed goods and items shall also be the responsibility and at the cost of the Supplier.

4.5 Training

Upon successful installation, the manufacturer shall provide a 5-day training program at CSIR-SERC. The training shall cover routine operation and maintenance of the UTM, hydraulic power pack, sub-systems, and cooling system.

Training materials shall be supplied by the manufacturer.

This training shall focus on the procured software, safety features and include demonstrations using actual test specimens.

During the warranty period, the vendor shall provide Training free of cost, as and when required.

4.6 Warranty

The warranty of the equipment should be for a period of **One year (12 Months)** from the date of final acceptance by CSIR-SERC.

4.7 Annual Maintenance contract (AMC)

4.8.1 The supplier has to quote for non-comprehensive AMC after the expiry of the warranty period, detailing the number of breakdown and preventive maintenance visit, exclusions if any and other terms and conditions.

4.8.2 The AMC cost will be consider for price evaluation of L1.

4.8.3 The bidder who emerges as L1 in the product will be asked to match the AMC cost of other bidders which is lowest as compared to his AMC cost.

4.8.4 In case AMC is freezed along with Purchase Order then payment of AMC will be released at the end of the each AMC period for the services provided terms and conditions have been adhered.

4.9 Incidental Services

Not Applicable

ANNEXURE – VII

REVISED TECHNICAL COMPLIANCE STATEMENT FORM/DEVIATION STATEMENT FORM

Parameters		SERC requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
1. Dynamic Force Capacity and Stroke length	1.1	**Dynamic force rating of ±2500 kN (Tension/compression).**			
	1.2	The static force rating shall be greater than or equal to the dynamic force rating capacity of ±2500 kN.			
	1.3	Actuator stroke should be ±150 mm, total stroke shall be 300mm.			
2. Actuator type	2.1	Double-ended, double-acting, equal area, cross-head mounted actuator.			
	2.2	Piston rod – one-piece, high tensile material with heavy chrome finish or better.			
	2.3	Low-friction and anti-rotating long-life bearings.			
	2.4	Fatigue life $\geq 10^9$ cycles or higher under fully reversed cycles.			
	2.5	The actuator should have safe normal and low flow velocity options.			
	2.6	The actuator/hydraulic manifold should have a safety mechanism to hold its position in the event of power loss.			
3. Load Frame	3.1	Sturdy self-straining, floor-standing and four-column-type frame with solid monolithically integrated T-slotted base plate at the floor of minimum size 800 mm x 1000 mm with minimum of 4 T-slots.			
	3.2	The maximum vertical test space without hydraulic grips should be $\geq$ 3000 mm.			
	3.3	Minimum clearance between side columns shall be 450 mm (side) x 700 mm (front) (i.e. clear width for test space).			
	3.4	The total height of the test system should not exceed 7000 mm.			
	3.5	The nominal stiffness of the load frame should be 3×10^9 N/m at 2m from the base of the frame.			
	3.6	Fatigue life of load frame - $\geq 10^9$ cycles.			
	3.7	The resonant frequency of the frame should be more than 20Hz.			
	3.8	Vibration isolation pads should be placed at the base of the load frame to minimise the vibrations during fatigue testing.			
	3.9	Moveable crosshead with hydraulic lift and lock control shall be provided.			
	3.10	Upper crosshead safety interlocks has to be integrated with the control system.			

4. Servo valves	4.1 Two separate servo valves of low and high flow capacity are to be provided with a manual shut-off valve.			
	4.2 The low-flow servo valve should have a maximum flow rating of 100 lpm or less.			
	4.3 The high flow servo valve should have a maximum flow rating of 300 lpm or more.			
	4.4 Suitable current-driven servo valves are to be provided to meet the following performance requirements.			
	4.5 **Low flow performance:** 2250 kN load, 0.5 Hz frequency, ± 1.5 mm amplitude and 2250 kN, 1 Hz frequency, ± 0.15 mm amplitude.			
	4.6 **High flow performance:** 2250 kN load, 0.5 Hz frequency, ± 9 mm amplitude and 2250 kN, 1 Hz frequency, ± 5 mm amplitude.			
	4.7 Suitable hydraulic service manifold has to be provided. **Performance curves, actuator, power pack and servo valve has to be provided for the stated amplitude and frequencies.**			
5. Force transducer (load cell) of capacity: **iii) 2500 kN – 01 No.** **iv) 250 kN – 01 No.**	**iii) Fatigue-rated force transducer (Tension/compression) of capacity ± 2500kN**			
	5.1 Hermetically sealed fatigue-rated load cell ± 2500kN capacity for both measurement and control.			
	5.2 The force transducer should be calibrated for 10%, 20%, 50% and 100% ranges of full scale (FS).			
	5.3 Accuracy class I - 0.5%			
	5.4 Linearity better than ±0.2% of full scale.			
	5.5 Hysteresis ≤ ± 0.2% of full scale.			
	5.6 Nominal output sensitivity at full scale load - 2 mV/V or better.			
	5.7 Safe overload ± 150% of full scaleor better.			
	5.8 Fatigue life of load cell $\geq 10^9$ under fully reversed cycles.			
	iv) **Fatigue-rated force transducer (Tension/compression) of capacity ± 250kN**			
	5.9 Hermetically sealed fatigue-rated load cell ± 250kN capacity for both measurement and control.			
	5.10 Accuracy class I - 0.5%			
	5.11 Linearity better than ±0.15% of full scale.			
	5.12 Hysteresis ≤ ± 0.15% of full scale.			
	5.13 Nominal output sensitivity at full scale load - 2 mV/V or better.			
	5.14 Safe overload ± 150% of full scale or better.			
	5.15 Fatigue life load cell $\geq 10^9$ under fully reversed cycles.			

	5.16 Both the dynamic load cells should meet the requirements of IS 1828 Part (1), IS 4166 and IS 1608 (ISO 75001/1 Class 0.5, ASTM E4, EN10002 Part 2, JIS (B7721, B7733) and ISO 10002 Part 2).			
	5.17 Dynamic systems using wedge grips should include ASTM E467-based dynamic calibration for the complete system with grips			
	5.18 The load output shall be processed through a signal conditioner within the controller to enable closed-loop control and data logging. The conditioned output shall be provided in the range of ±10 V.			
	5.19 The transducer shall be supplied with a traceable calibration certificate issued by a reputed, accredited laboratory from the country of origin.			
6. Displacement measurement	6.1 Actuator stroke to be measured using coaxially mounted internal LVDT.			
	6.2 An integral displacement transducer (AC-LVDT) of ±150 mm stroke is to be provided.			
	6.3 Accuracy better than ±0.5% of FS as per ASTM E2309.			
	6.4 Linearity better than 0.5% of FS displacement. 6.5 Transducer outputs has to be conditioned at the controller for closed-loop control and data logging purpose. The conditioned output should be ± 10 V.			
	6.6 The transducer shall be supplied with a traceable calibration certificate issued by a reputed, accredited laboratory from the country of origin.			
7. Extensometers	7.1 **Axial strain measurement for steel -01 No.** Extensometer travel ± 5 mm. Varying gauge length options- 12.5 mm, 25 mm and 50mm. Suitable for flat and round steel specimens.			
	7.2 **Axial Strain Measurement for concrete-02 Nos.** Dual Averaging Axial Extensometer for axial strain measurement. Two strains shall be averaged for a more accurate measurement. Extensometer travel is ± 4.00 mm. Strain calibrations for dual averaging measurement: 10% 20%, 50% and 100% of full scale. Varying gauge lengths of 100mm, 150mm, and 200mm shall be provided.			

	7.3 **Circumferential Strain Measurement for Concrete-1 No.** Circumferential Extensometer of chordal travel length +12.5/-2.5mm for measurement of poisons ratio and to control the testing. This extensometer is typically used with an axial extensometer package to determine Poisson's ratio and to control testing. Minimum diameter of specimen to be measured is 50mm. Circumferential Chain suitable for 100mm and 150mm diameter specimens.			
	Cable length 20 m to be provided from the controller to the load frame and 2 m from the load frame to the specimen for the extensometers.			
	The transducer output shall be conditioned within the controller to facilitate closed-loop control and data logging. The conditioned output shall be provided in the range of ±10 V.			
8. Hydraulic Grips	8.1 Hydraulic grips for tension testing of circular rods and flat specimens with a dynamic capacity of +/-1000kN and static capacity of 1200kN or higher, capable of fully reversed fatigue loading. 8.2 The hydraulic grip should be controlled through a stand-alone hydraulic grip control and supply.			
	8.3 The grip controller should have an adjustable pressure control system to grip and un-grip the test specimen. An independent grip pressure control has to be provided for both upper and lower grip with a separate pressure gage/indicator for both the upper and lower grips.			
	8.4 Pressure stability variation during gripping should not exceed ± 0.07 MPa.			
	8.5 The grip unit should contain pressure gauge to monitor the gripping and un-gripping operations.			
	8.6 Suitable set of spiral washers should be provided to ensure backlash-free and offset-free pre-loading for fatigue loading.			
	8.7 Hydraulic grip should accommodate flat inserts and Vee wedge inserts.			
	8.8 Wedge inserts should be provided for round specimens with diameters ranging from 10 mm to 40 mm.			
	8.9 Wedges should be provided for flat specimens with thicknesses ranging from 0mm to 40mm.			
	8.10 Rebar wedges to be provided for bar diameters ranging from 10mm to 40mm.			

	8.11	The firm should have supplied at least 4 units of similar capacity dynamically rated hydraulic grip supply units in India. Details of the clients to whom such hydraulic grip and wedge inserts have been supplied, along with their addresses, contact person, email and telephone numbers, should be submitted with the technical bid. Both the hydraulic grip and wedge inserts should be covered under warranty.			
9. Compression platen	9.1	Upper and bottom platens of 300 mm diameter for uniform loading of test specimens.			
	9.2	Spherical seat for upper platen for proper axial loading of the test specimen.			
	9.3	Compression platen to be made up of hardened alloy steel of hardness R_c 58 or higher.			
	9.4	Bottom platen to be etched smoothly with concentric rings for centering specimens.			
	9.5	Suitable mating connectors (studs) should be provided with the system to connect with and without hydraulic grips.			
10. Computer-controlled Digital Controller	10.1	The controller must allow tests in load, stroke, and strain control (via internal LVDT or external extensometers). The system should support two independent strain control channels.			
	10.2	Controller shall support Proportional, Integral, Derivative, and Feed-forward (PIDF) control.			
	10.3	High-precision digital signal conditioners and valve drivers should be provided for the control signals.			
	10.4	Controller must allow for any inputs (minimum of four) to be assigned to any control channel by the user without requiring re-arranging controller hardware.			
	10.5	Control software shall have the ability to automatically recognize added controller hardware (TEDS).			
	10.6	Controller must have minimum 8 digital input and output (DIO) and 8 analog output of ±10 V should be provided for external data logging and external control mode.			
	10.7	Controller must have option to control or acquire data up to 5 kHz for at least 8 external analog signals.			
	10.8	Continuous synchronous data acquisition at user-selectable sampling rate with a maximum of 5 kHz on all internal and external channels.			
	10.9	Controller shall support channel control mode with the second feedback signal for controlling the actuator for safe specimen installation and removal during testing. It should prevent the actuator from exceeding user-defined limits on either			

	the active or limiting channel.			
	10.10 Controller shall support Dual Mode control with two feedback signals to provide better control stability.			
	10.11 The controller must allow for any output channels and input channels to be configured by the user via software, without requiring any controller hardware to be rearranged.			
	10.12 Controller must be expandable to at least two independent test stations with additional hardware in the same controller.			
	10.13 Controller must support either 2 or 3 stage valve drivers			
	10.14 Bumpless switch-over from one control mode to another control mode with and without hydraulics.			
	10.15 Controller should have adaptive Control System, allowing continuous update of PID terms for specimen stiffness and automatically compensating at a minimum frequency of 1 kHz with auto and manual tuning facility.			
	10.16 The Controller should adapt for Peak/Valley control, Amplitude/Mean control, Amplitude and Phase control. Control loop update should be 5 kHz or faster. Loop closure rate should not be affected by number of control channels.			
	10.17 Auto Loop Shaping: Position, Load, and Strain. Multi term control, including PID, lag, feed forward and compensation, with serial, parallel and cascade control. High speed computer interface, using the industry-standard Ethernet/USB.			
	10.18 Transducer signal conditioners for load, stroke, extensometer, COD (crack opening displacement) and external strain sensors to provide high accuracy, low drift and low noise transducer signal with user-selectable standard filters.			
	10.19 Digital sensor conditioners providing minimum 16 bit data resolution across the complete span of the sensor. Interlocks and indicators are to be provided for transducer excitation failure and conditioner saturation			
	10.20 Automatic transducer recognition and calibration to be provided.			
	10.21 All adjustments on the signal conditioners are to be made by software.			
	10.22 Programmable limit/event detection for providing rapid intelligent actions or test interruptions.			
	10.23 User selectable limit/event detector actions such as hydraulic off, indicate, hold, change mode and hold, reset, unload, and no action has to be provided.			
	10.24 Programmable display meters for providing the user flexibility of programming and the parameters to be			

	displayed on the meters.			
	10.25 All test templates that support testing against standards can be modified by the user, using the graphic interface (no requirement to change source code).			
	10.26 All variable definitions and calculations as well as the test flow/sequence and logic are visible and can be changed by the user.			
	10.27 The user should be able to select any of the following parameters for display cyclic/ramp signal track, mean, amplitude, min., max., peak, valley, current cycle count, total cycle count, segments etc.,			
	10.28 The user should be able to generate as many number of display meters as required to display the above parameters based on the requirement.			
	10.29 Programmable display scopes for providing the user the flexibility of programming the parameter to be displayed on X and Y axis. The user should be able to select any of the following parameters for the Y axis: load, stroke, COD, extensometer output, external LVDT output, command, servo drive, error etc. The user should be able to select any of the following parameters for the X axis: time, load, stroke, COD and extensometer outputs. User should be able to adjust the scaling and trace time based on the requirement. The scope should have user selectable and auto scaling features. The scope should be able to plot one channel versus another channel.			
	10.30 Programmable automatic dynamic mode changing to any transducer connected to the machine, which has been selected for control, including load-limited displacement during specimen loading.			
	10.31 Waveform command generation with 32 bit resolution up to 500 Hz for each sensor, with, sine, triangle, square, haversine, havertriangle, haversquare, ramp, dual ramp, trapezoid in relative and absolute modes and support for digital drive data or an analog input of ±10 V.			
	10.32 The controller with necessary software should be able to run static and fatigue tests and data acquisition should have the following features: ✓ Selection of wave form type, timed sample, peak / valley, max / min, level-crossing, cyclic / logarithmic and mean/amplitude with ability to tie data channels to a master signal. Starting quadrant, and number of cycles to stop, action to be taken at the end of the defined test. ✓ Run, hold, continue, and stop buttons for controlling the test. ✓ Online instantaneous adjustment of frequency, amplitude, and mean of the			

	cyclic waveform tests. ✓ Online visual indication of limit settings and status. ✓ Data acquisition and storage of external and internal signals with a user-adjustable sampling rate. The data acquisition mode in the form of maximum and minimum, level crossing, peak valley, continuous and high speed. ✓ The user should be able to switch on / off hydraulics from the controller. The user should start, pause and stop the test program. ✓ An emergency switch-off button should be provided in the load frame, hydraulic power pack and near the controller.			
	10.33 The controller shall comply with the requirements of IS/IEC 61010 – Safety requirements for electrical equipment for measurement, control, and laboratory use.			
11. Application software package	11.1 The software should be able to carry out the waveform profiles such as sine, triangle, haversine, square, ramp, trapezoid, etc., for conducting basic static and fatigue tests.			
	11.2 The software must support the following tests: • Random/block profile playback, • High-cycle and crack growth testing • Resume from power failure, • Custom command logic, • Parallel branching and event-based data logging.			
	11.3 The software packages should have real-time graphic options, formula calculations, and data in the form of ASCII and Excel formats. The software shall be used for generating and executing tests. The software should have the ability to control or capture the data from the internal and external transducers.			
	11.4 Random\field data\profile playback software for playback of field data obtained from components undergoing service conditions/constant amplitude fatigue. The software should be able to read the profile data file created using a spreadsheet or a text editor.			
	11.5 The block loading software should be able to continue the block segment when the test system stops due to a power failure or user-defined test termination, and it should resume from the block segment where it was stopped when the user restarts the test system.			
	11.6 The software should have the capability to change, view, create, edit and create loops in the process variables as per the user commands with ease.			
	11.7 Software test design to support parallel branches for test execution and logical operators (if/then, while).			

	11.8	The software should have a feature to allow data to be collected and stored to disk during any simple or complex testing.			
	11.9	The data acquisition routines shall include time data collection, peak valley, maximum/minimum and level crossing data acquisition and the additional slave channels to be collected simultaneously. All internal conditioned channels can be used as the master or as the slave channel.			
	11.10	The software shall allow the operator to directly interact with the progress of the test through user-defined software buttons.			
	11.11	The user should be able to define customised software buttons with names and descriptions that, when clicked with the mouse, cause the test program to sequence to the next desired test sequence.			
	11.12	The software shall allow the user to set up command segment end levels that are from a different transducer channel than the channel being used for test control. The end level or data limit can be set up to terminate the current segment when the data limit is approached from below, above or either direction. The data limit can also be used to trigger data acquisitions and other definable test system processes. Data limits can be set up to cause the test system to go to any definable state upon detection.			
	11.13	The software shall have an event detector watching for changes in peak-valley readings. The process can be used to trigger data collection or other definable test system processes.			
	11.14	The various display on the computer monitor during testing should be legible, easy to read, including the font size.			
	11.15	During testing, when the power supply stops suddenly and unexpectedly, the test should stop at the stage of the testing without any damage to the test specimen or test setup. The hydraulics should immediately disengage completely without any application of load to the test system.			
	11.16	Further, it should be able to resume the same test from that point onwards, where it had stopped.			
	11.17	Test software to provide standard templates for running tensile tests on rebar specimens.			
	11.18	Software to have a freely configurable run time view (show an unlimited number of variables, meters, charts and tables). Should show the test flow while the test is proceeding, indicate active vs. finished actions.			
	11.19	The system should be usable under local conditions, and must be installed and commissioned with no additional			

	costs.			
12. Computer	12.1 The supply shall have latest hardware and operating system for interfacing with the digital controller.			
	12.2 **Computer specifications:** Processor and speed: Intel Core i9, 12th generation Ram:32GB Hard disk (SSD): 1TB OS: Windows-11 or latest at the time of supply. Monitor: 30-inch LED dual monitor.			
	12.3 For technical reasons, if the supplier wishes to offer a computer system with different specifications, then the same should be justified and detailed specifications of the computer system shall be given. It is the responsibility of the quoting firm to ensure complete compatibility between the testing system, test software and the computer system.			
13. Hydraulic power pack	13.1 **Total flow capacity of the hydraulic power pack** The minimum total flow capacity of the power pack should be 300 litres per minute.			
	Minimum reservoir capacity shall be 1200 litres, and it should be enough to operate continuously for at least 16 hours under the performance stated in Sl. No.4, considering the capacity of cooling unit			
	Corrosion resistant copper oil to water heat exchanger to dissipate all heat generated by the power unit. Heat exchanger must be designed for cooling water inlet at 25 Deg. C.			
	Pumps should be able to support 2 or more test systems.			
	13.2 **Operating pressure of the power packs**: 210 bar (3000 psi).			
	13.3 **Rated pressure of the power pack component**: Minimum 280 bar (4000 psi)			
	13.4 **Type of hydraulic pump for power packs:** The pump and motor should be of a submerged pressure-compensated variable-displacement and variable flow type.			
	13.5 **High-pressure and low-pressure oil filtration:** Three-micron high-pressure filter to be provided for system filtration at the outlet of the pump.			
	Ten-micron low-pressure filter shall be provided for system filtration at the inlet of the power pack reservoir			
	13.6 **Accumulators:** High-pressure accumulators of suitable capacity are to be provided at the outlets of the pumps to manage surges in flow demand.			
	13.7 **Sensors to monitor vital parameters:**			

	Suitable sensors to be provided to monitor rate of oil flow, oil pressure, oil temperature, oil level in the tank, filter block condition, cooling water temperature etc.,			
	13.8 **Hydraulic oil:** The first oil fill of the power pack should be filled by the vendor. Mineral-based equivalent to DTE25, servo 46, or Shell Tellus 46 AW (to be supplied), oil required for initial flushing also to be included in the supply.			
	13.9 **Operating features:** Touch screen-based Programmable Logic Controller (PLC) of size 6" or above to be provided with the following features for the operation of the power pack: +			
	Remote and Local control of the power pack The power pack should be provided with an integral front panel PLC control, and it should be operated remotely through the controller of the UTM located in the control room.			
	Normal mode operation Power pack has to be started in low-pressure mode and then the system pressure needs to be raised to the nominal operating pressure (3000 psi) smoothly			
	Cooling mode operation When the oil temperature exceeds the prescribed limit due to unforeseen circumstances, it should be possible to operate the cooling pump alone and circulate the oil in the heat exchanger at low pressure to bring down the oil temperature.			
	Flushing mode operation • In flush mode operation, the power pack should circulate the hydraulic oil at low pressure in the hydraulic circuit for flushing. • The PLC operator control panel should indicate the status of the power pack, such as mode of operation, rate of oil flow, oil pressure, oil temperature, oil level in the tank, oil filter condition, safety interlock conditions, etc., • Manual override option has to be provided for the interlocks, for operating the power pack in normal mode for a short duration.			
	13.10 **Safety and interlock features:** The power pack should shut down in the following circumstances • If the oil temperature exceeds, or falls below, the pre-set values • If the oil level in the reservoir tank drops below a minimum level • If the pressure in the system exceeds or falls below the pre-set value • If the motor current or temperature exceeds the pre-set value • Pressure Relief Valve has to be provided as a safety mechanism for preventing the power packs operating at more than the normal operating pressure			

	13.11 Electrical supply available for the operation of the power packs: Three phase 400 V ± 6 %, 50 Hz			
	13.12 **Acoustic attenuation:** The power packs has to be provided with acoustic attenuation to reduce the noise output from the power pack to less than 70 dB at a distance of 1m.			
14. Hydraulic service manifold (HSM)	Independent hydraulic service manifold with on/off low- and high-pressure control shall be provided with the following functions: 14.1 HSM should have smooth, controlled transitions of oil flow to enhance system safety.			
	14.2 HSM should have a provision to minimise the rapid application and removal of high pressure during abnormal operation.			
	14.3 HSM to be provided with rapid dump hydraulic pressure unloading features in the event of any abnormal operation or potentially hazardous conditions			
	14.4 Suitable pressure accumulators to be provided in the pressure and return line to minimise the effect of pressure fluctuations.			
	14.5 Slow pre-filling to 75% of nominal pressure for smooth start-up.			
	14.6 Maximum operating pressure of HSM is 3000 psi.			
	14.7 Ability to set variable low pressure from about 1 to 20 MPa is required.			
	14.8 Hydraulic manifold with on/off low- and high-pressure control; software selectable.			
	14.9 Accumulators of a minimum 4-litre capacity are to be provided for smoothing out pressure fluctuations.			
	14.10 Pressure line and return line filters of the required size are to be provided for removing any contamination in the oil. Filter interlock should be provided.			
15. Flexible hydraulic hoses	15.1 Flexible hoses (pressure, return, and drain/pilot) of required length from the HSM to the hydraulic power pack (to suit the site conditions).			
	15.2 Flexible hoses (pressure, return, drain/pilot) of required length from HSM to load frame (to suit the site condition).			
16. System cables	16.1 System cables of required length (to suit the site condition) from the controller to the UTM.			
	16.2 System cables of required length (to suit the site condition) from the controller to the HSM.			
17. Warranty	17.1 One-year warranty followed by three years AMC. The bid should include three years of AMC after one year of warranty. The AMC charges will be taken for evaluating the bid.			
	17.2 The commercial quote should include the charges for the above.			
18. Installation and	18.1 The firm should take full responsibility			

commissioning	for the supply, installation and commissioning of the equipment. Installation and commissioning should be carried out in CSIR-SERC, and performance of the system should be demonstrated to the satisfaction of the users in CSIR-SERC.			
19. Acceptance test	19.1 Acceptance tests shall be conducted on the supplied equipment in India. The vendor's technical bid will be evaluated based on the performance of these tests. Failure to meet any of the acceptance test criteria will result in outright rejection of the technical bid. CSIR-All the tests mentioned below must be successfully demonstrated by the vendor: 19.2 **Concrete Cylinder Testing (Stress-strain):** Demonstration of compression test on concrete cylindrical specimens (150x300mm) mounted with a dual averaging extensometer and circumferential extensometer. The test should be strain-controlled (using an axial extensometer and a circumferential extensometer), showcasing its ability to capture the full stress-strain behaviour of concrete cylinders, including the post-peak response.			
	19.3 Notched Flexural Beam Testing: Demonstration of flexure test on notched concrete beam using external LVDT and CMOD gauge for control at loading rate of 0.05 mm/min, to evaluate flexural performance and crack propagation characteristics.			
	19.4 Steel Rebar Testing: Demonstration of cyclic strain-controlled tests on steel reinforcement bars (rebars) using extensometer.			
20 Operation and maintenance training.	20.1 Installation and Commissioning The system shall be installed and commissioned at CSIR-SERC by the manufacturer, using trained and experienced service engineers.			
	20.2 Training Program Upon successful installation, the manufacturer shall provide a 5-day training program at CSIR-SERC.			
	The training shall cover routine operation and maintenance of the UTM, hydraulic power pack, sub-systems, and cooling system.			
	Training materials shall be supplied by the manufacturer.			
	This training shall focus on the procured software, safety features and include demonstrations using actual test specimens			
	During the warranty period, the vendor shall provide hands on support at free of cost, as and when required.			

21 Maintenance and service support of the equipment during and after the warranty period.	21.1 The vendor should have a competent and reliable service network in India for quick and necessary repair and maintenance of the equipment. Details of the nature of service support the firm can provide should be given along with the bid. The firm should commit to provide maintenance service and supply necessary spares for the equipment for at least 10 years after successful installation and commissioning.			
	21.2 The details submitted by the vendor regarding service and maintenance support shall be subject to evaluation by CSIR-SERC.			
22 Software, operating system and related hardware	22.1 The vendor should agree to give technical and service support to the test software, operating system and related hardware for a minimum period of 10 years from the date of completion of installation and commissioning.			
23 Technical documents and catalogues	23.1 The vendor should enclose all the relevant technical documents and catalogues for all the components included in the quotation.			
24 Compliance statement	24.1 Compliance statement, clearly mentioning point-wise compliance, should accompany the main technical offer.			
25 Operation and maintenance manuals	25.1 Two sets of operation and maintenance manuals along with all necessary drawings should be supplied along with the testing system.			
	25.2 Backup pen drive for total firmware, background software and the application software packages should be supplied.			

ANNEXURE –XIV

Format of Integrity Pact

INTEGRITY PACT

Between

Council of Scientific & Industrial Research (CSIR) a Society registered under the Indian Societies Act 1860 represented by _____ hereinafter referred to as "The Principal".

And .....herein referred to as "The Bidder/ Contractor."

Preamble

The Principal intends to award, under laid down organizational procedures, contract/s for .....The Principal values full compliance with all relevant laws of the land, rules, regulations, economic use of resources and of fairness/ transparency in its relations with its Bidder(s) and/or Contractor(s).

In order to achieve these goals, the Principal will appoint an Independent External Monitor (IEM), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1 – Commitments of the Principal

(1) The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:

(a) No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

(b) The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

(c) The Principal will exclude from the process all known prejudiced persons.

(2) If the Principal obtains information on the conduct of any of its employees which is a criminal offence under the IPC/PC Act, or if there be a substantive suspicion in this regard, the Principal will inform the Chief Vigilance Officer and in addition can initiate disciplinary action.

Section 2 – Commitments of the Bidder(s)/Contractor(s)

(1) The Bidder(s)/Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

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Controller of Stores & Purchase
सीएसआईआर-संरचनात्मक अभियांत्रिकी अनुसंधान केन्द्र
CSIR - Structural Engineering Research Centre
सी.एस.आई.आर. रोड, तरमणि, चेन्नै-600 113.
CSIR Road, Taramani, Chennai - 600 113.

(a) The Bidder(s)/Contractor(s) will not, directly or through any other Person or firm, offer, promise or give to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

(b) The Bidder(s)/Contractor(s) will not enter with other Bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, Certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

(c) The Bidder(s)/Contractor(s) will not commit any offence under the relevant IPC/PC Act; further the Bidder(s)/Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

(d) The Bidder(s)/Contractor(s) of foreign origin shall disclose the name and address of the Agents/representatives in India, if any. Similarly the Bidder(s)//Contractors(s) of Indian Nationality shall furnish the name and address of the foreign principals, if any. Further details as mentioned in the "Guidelines on Indian Agents of Foreign Suppliers" shall be disclosed by the Bidder(s)/Contractor(s). Further, as mentioned in the Guidelines all the payments made to the Indian agent/representative have to be in Indian Rupees only. Copy of the "Guidelines on Indian Agents of Foreign Suppliers" is annexed and marked as Annexure.

(e) The Bidder(s)/Contractor(s) will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

(2) The Bidder(s)/Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

Section 3 – Disqualification from tender process and exclusion from future Contracts

(1) If the Bidder(s)/Contractor(s), before award or during execution has committed a transgression through a violation of Section 2, above or in any other form such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/Contractor(s) from the tender process or take action as per the procedure mentioned in the "Guidelines on Banning of business dealings". Copy of the "Guidelines on Banning of business dealings" is annexed and marked as Annex -"B".

Section 4 – Compensation for Damages

(1) If the Principal has disqualified the Bidder(s) from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.

(2) If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to Section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages of the contract value or the amount equivalent to Performance Bank Guarantee.

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Section 5 – Previous transgression

(1) The Bidder declares that no previous transgressions occurred in the last 3 Years with any other Company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.

(2) If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or action can be taken as per the procedure mentioned in "Guidelines on Banning of business dealings."

Section 6 – Equal treatment of all Bidders / Contractors/ Sub-contractors

(1) The Bidder(s)/Contractor(s) undertake(s) to demand from all Subcontractors a commitment in conformity with this Integrity Pact, and to submit it to the Principal before contract signing.

(2) The Principal will enter into agreements with identical conditions as this one with all Bidders, Contractors and Subcontractors.

(3) The Principal will disqualify from the tender process all bidders who do not sign this Pact or violate its provisions.

Section 7 – Criminal charges against violating Bidders / Contractors/ Subcontractors

(1) If the Principal obtains knowledge of conduct of a bidder, Contractor or Subcontractor or of an employee or a representative or an associate of a bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the same to the Chief Vigilance Officer.

Section 8 - Independent External Monitors

(1) The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.

(2) The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the JS (A), CSIR.

(3) The Bidder(s)/Contractor(s) accepts that the Monitor has the right to access without restriction to all Project documentation of the Principal including that provided by the Contractor. The Contractor will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation. The same is applicable to Subcontractors. The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Subcontractor(s) with confidentiality.

(3) The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the Project provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.

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(5) As soon as the Monitor notice, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or take corrective action, or to take other relevant action. The monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

(6) The Monitor will submit a written report to the JS(A), CSIR within 8 to 10 weeks from the date of reference or intimation to him by the Principal and should the occasion arise, submit proposals for correcting problematic situations.

(7) Monitor shall be entitled to compensation on the same terms as being extended to/provided to Independent Directors on the CSIR.

(8) If the Monitor has reported to the JS(A), CSIR, a substantiated suspicion of an offence under relevant IPC/PC Act, and the JS(A), CSIR has not, within the reasonable time taken visible action to proceed against such offence or reported it to the Chief Vigilance Officer, the Monitor may also transmit this information directly to the Central Vigilance Commissioner.

(9) The word 'Monitor' would include both singular and plural.

Section 9 – Pact Duration

This Pact begins when both parties have legally singed it. It expires for the Contractor 10 months after the last payment under the contract, and for all other Bidders 6 months after the contract has been awarded.

If any claim is made/lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged/determined by JS(A), CSIR.

Section 10 – Other provisions

(1) This agreement is subject to Indian Law. Place of performance and Jurisdiction is the Registered Office of the Principal, i.e. New Delhi

(2) Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.

(3) If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

(4) Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

(For & On behalf of the Principal)
(Office Seal)

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Place.....

Date.....

Witness 1:(Name & Address):

(For & On behalf of Bidder/Contractor)
(Office Seal)

Place.....

Date.....

Witness 2:(Name & Address):

ANNEXURE -XVII

Undertaking for Technical Demonstration

Tender No: _____ Date _____

To,
The Director,
CSIR-SERC
CSIR Road, Taramani
Chennai - 600113

Sir,

I hereby certify that and agree that I will show a demonstration of the product quoted during the technical evaluation for getting qualified technically.

Acceptance Tests to be carried out:

Concrete Cylinder Testing (Stress-strain):

Demonstration of compression test on concrete cylindrical specimens (150x300mm) mounted with a dual averaging extensometer and circumferential extensometer. The test should be strain-controlled (using an axial extensometer and a circumferential extensometer), showcasing its ability to capture the full stress-strain behaviour of concrete cylinders, including the post-peak response.

Notched Flexural Beam Testing:

Demonstration of flexure test on notched concrete beam using external LVDT and CMOD gauge for control at loading rate of 0.05 mm/min, to evaluate flexural performance and crack propagation characteristics.

Steel Rebar Testing:

Demonstration of cyclic strain-controlled tests on steel reinforcement bars (rebars) using extensometer.

In case of failure to show the demo of my product, my bid can be rejected.

For and on behalf of **(Name of firm/entity)**
Authorized signatory (To be duly authorized by the Board of Director)