CSIR-NML

सीएसआईआर - राष्ट्रीय धातुकर्म प्रयोगशाला
(सीएसआईआर की एक संघटक प्रयोगशाला, विज्ञान एवं प्रौद्योगिकी मंत्रालय)
भारत सरकार, बर्मामाइंस, जमशेदपुर - 831007, झारखंड (भारत)

CSIR-National Metallurgical Laboratory
(A Constituent Laboratory of CSIR, Ministry of Science & Technology)
Govt. of India, Burmamines, Jamshedpur - 831 007, Jharkhand (India)

10.11.2026

CORRIGENDUM

Tender Reference No. :- PUR/1135/HNB/DB/GTE/25-26

Tender ID :- 2026_CSIR_294815_1

Item Name :- Supply, Installation & Commissioning of SERVO-ELECTRIC FATIGUE TEST SYSTEM WITH HIGH PRESSURE - HIGH TEMPERATURE AUTOCLAVE

NOTE: The Bids must be submitted in the Central Public Procurement Portal (URL:https://etenders.gov.in/eprocure/app) only. Manual/Offline bids shall not be accepted under any circumstances. Bidders should quote in INR only.

Consequent to the Pre-Bid Meeting held on 27.10.2026, the revised technical specifications are attached in Annexure-A.

The bidders are requested to submit their bid based on this revised technical specifications as per Annexure-A.

Further, the bid submission end date and date of opening of bid are extended as follows:-

Bid Submission End Date	30.11.2026 (03.00 PM)
Bid Opening Date	01.12.2026 (03.00 PM)

All other terms and conditions shall remain same.

11.11.2026

Stores & Purchase Officer,
CSIR-NML, Jamshedpur

ANNEXURE-A

Servo-Electric Fatigue Test System with High Pressure - High Temperature Autoclave

Quantity : 01 Nos

Purpose:

Servo-electric close loop test system is required for conducting elevated temperature static and dynamic mechanical tests in high-pressure gaseous hydrogen environment within an autoclave. The system should be capable of performing low frequency fatigue (ASTM E 606) tests, Fatigue Crack Growth Rate (FCGR) tests (ASTM E 647) and Fracture Toughness tests (ASTM E1820 / E1681). The tests will demand long duration experiments, glitch free through zero load traverse and load/position /strain reversing. These features should be supported by documentary evidence. Conventional electro-mechanical systems that are not capable of performing very slow rate tests; cyclic operation and/or glitch free through zero traverse will not be acceptable. Similarly, the load frame should be integrated with a high temperature and high-pressure autoclave equipped with all necessary safety features to handle high-pressure gaseous hydrogen atmosphere. Detailed specifications of the requirement are furnished below:

A.	**Load Frame and Controller for Pressurized Hydrogen Atmosphere**		Qty
1.	**Load Frame capacity and features**		01
	± 250kN or better, fatigue rated load frame		
2.	**Servo-electric actuator**		01
	i. ± 100kN capacity, fatigue rated actuator ii. Actuator mounted at the base platen iii. Actuator displacement range ± 50mm or more (cross-head displacement will not be considered as actuator displacement) iv. Fitted with anti-rotation clamping Test speed: Minimum: 0.0001 mm/min or lower Maximum: 150 mm/min or higher Test Frequency : 0.001 Hz to 1.0 Hz (System capable of covering frequencies less than 0.001Hz and more than 1.0Hz are also acceptable)		
3.	**Load Cell**		01
	i. Strain gauge based, fatigue rated ii. ± 100kN capacity with cooling arrangement (if necessary) for high temperature testing up to 300°C iii. Accuracy : 0.5% of reading down to 1/250th of the load cell full scale complying International standard such as ISO 7500-1 class 0.5, EN10002-2 class 0.5 iv. Adaptors flanges for grips/tooling must be included		
4.	**Digital Control System,**		**01**
	i. Integrated adaptive controller for automatic control parametezation ii. Minimum 4 sensor conditioning cards: one each for stroke, load and strain (COD/Extensometer), and one configurable for DCPD or any other transducer iii. Control Mode: Stroke, Load and Strain iv. Closed loop continuous PID control at rate of 1kHz or better v. 19 bit data resolution on all channels or better		

	vi. Programmable event detection and limit set-up on all channels vii. Continuous, synchronous data acquisition on all channels at least at 10kHz or better viii. Command waveform generator with 32 bit resolution (for sine, triangular, ramp, trapezoidal and square waveforms) for each transducer ix. At least 3 digital IO and 3 analogue outputs x. Ethernet/GPIB/IEEE/IO module/USB interface for external control and data acquisition xi. Transducer excitation, automatic transducer recognition and transducer calibration functions xii. Specimen protect facility xiii. Provision for continuous monitoring and recording of test temperature xiv. Playback facility of service data or user-defined loading paths as digital command files xv. For safety, the system should have two modes of operation, viz., (i) set-up mode, wherein only position control can be accessed with slow actuator velocity and (ii) test mode wherein position, load and strain control are enabled.	
B	**Attachments and Software**	
5.	**CT Clevis (As per ASTM E399, E647, E1820) & Adaptors suitable at operating pressure and temperature with gaseous hydrogen atmosphere application**	
	i. 1T CT clevis (static capacity min 80kN and dynamic capacity min 40kN at specimen temperature of 200°C) along with loading pins, capable of being used for tests up to 300°C. Note: Proposed 1T CT specimen dimension: W=50mm, B=25.4mm, Hole dia=12.7mm ii. ½T CT clevis (static capacity min 20kN and dynamic capacity min 10kN at specimen temperature of 200°C) along with loading pins, capable of being used for tests up to 300°C. Note: Proposed ½ CT specimen dimension: W=25.4mm, B=12.5mm, Hole dia=6.25mm iii. For both specimen dimensions, the dimensional tolerance will be as per ASTM standard iv. Adapters/Connecting rods/studs, additionally required beyond those, which are specified in Sl. No. #7 (as described in subsequent section), for attaching both types of CT clevises and should be included v. CT clevises and/or connecting rods should be suitably electrically isolated from the machine load frame for use with DCPD system	**1 Pair** **1 Pair**
6	**Grips and adaptor for Round Specimen suitable at operating pressure and temperature with gaseous hydrogen atmosphere application**	
	i. One set of each grip for threaded M8, M12 and M16 specimen ii. Suitable hydrogen resistant adaptors iii. On specimen Temperature Range: Minimum: Room temperature (RT~25°C) Maximum: 200°C	
7	**Hydrogen Autoclave with protection device for test frame** *All materials that will come in direct contact with hydrogen should be compatible with operating pressure and temperature gaseous hydrogen environment:*	**01**

	i. Capable to operate at gas pressure of 400 bar or higher ii. Capable of conducting long term tests on specimen temperature – minimum 25°C (i.e., RT) to maximum 200°C or higher iii. Mechanical pressure compensation on applied load on specimen should be included for balancing the internal pressure of pressure vessel iv. Side port, top/bottom insulation plugs v. Support brackets for mounting on machine frames vi. Specimen holder/adopter for tensile and CT specimens vii. Nitrogen gas booster system with two pull rod gasket depressurization cells and back pressure valve. viii. Hydrogen resistant flanges should be compatible to internal pressure. ix. Provision for minimum two number of high-pressure feedthrough for accommodating COD gauge/extensometer and DCPD connections simultaneously x. Feedthrough for attaching thermocouples xi. Programmable PID controller for heating rate and temperature set point. xii. Temperature overshoot on heating: ±0.5% of set point or better xiii. It should include audio and visual alarm for overshoot in temperature and pressure. xiv. Vent protection for safeguarding the system against hydrogen leakage. xv. Provision of sensors/safety switches, as the case may be, for gas leak detection and safe cut-off. xvi. Necessary high pressure hoses, fittings and pressure booster (Minimum TWO stage) etc., for connecting gas cylinder to autoclave (test chamber) to be included in the offer. xvii. Autoclave should be manufactured from forged material with UT qualification certificate. xviii. Autoclave should be manufactured and designed in accordance with the applicable international standard (ASME Sec. Div. 1 &2, ASME B31.3, Europian) and the relevant documentary evidences should be provided. Also, quality inspection documents for pressure vessel materials and operating pressure validation certification should be provided.	
8	**COD Gauges and Extensometer suitable for high pressure (400 bar) and temperature (200°C) with gaseous hydrogen atmosphere application**	
	i. **Clip On Displacement Gauge** Gauge length : 5mm ii. Travel : +2.50mm, -1.00mm iii. Minimum Temperature : Room Temperature or lower iv. Maximum Temperature : 200°C or higher v. Fatigue rated vi. Configured for auto recognition and auto calibration with the machine control software **Axial Extensometer** vii. Gauge length : 12.5mm viii. Travel : ±5mm ix. Minimum Temperature : Room Temperature or lower x. Maximum Temperature : 200°C or higher xi. Fatigue rated xii. Configured for auto recognition and auto calibration with the machine control software	01 01
9	**DCPD System suitable for high pressure and temperature with gaseous hydrogen atmosphere application**	01
	i. Pulsed reversible DCPD system with voltage amplifier for crack length measurement	

	ii. Variable pulsed current from 0 to 20A (or higher) in steps of 10mA iii. Current stability should be 0.01%, or better iv. Crack change detection (da) resolution: ≤10 μm v. Crack growth rate (da/dt) resolution: ≤5E-12 m/s vi. DCPD unit should be fully integrated with servo-electric test frame and testing software(s) such that it is ready to use. vii. Simultaneous measurement of all variables (X/Y signals, current, voltage at load) viii. All connections to the specimens should be isolated from each other and the main supply ix. Option for controlling the unit both from control unit of the DCPD system and using software x. All cables and leads (current input, voltage pickup, interfacing) suitable for conducting FCGR tests at high temperatures up to 200°C to be provided xi. Hydrogen resistant Screws, bolts and nuts for attaching cables and leads to specimens to be provided, including sufficient spares for conducting at least 50 tests **xii.** DCPD device should comply requirements as per ASTM E 647/ASTM E1820/ E1620	01
10	**Software for LCF**	**01**
	i. A user-friendly software for conducting LCF tests as per ASTM E 606 standards. ii. The software should be able to conduct the tests under load and strain control. iii. Provision for performing tests under total strain control. iv. Provision for various test end criteria decisions (cycle based, load based, elastic modulus change) v. Availability of pre-defined waveforms (sine, triangular, trapezoidal) Continuous synchronous data collection on all channels, at linear, logarithmic and change in value as per user defined interval should be possible vi. Provision for collecting both complete cycle data and peak-valley data vii. Data storage in PC in ASCII or any other transferable form to external spread sheet (eg., Excel) viii. Ability to pause and resume a test ix. Real time graphic windows (X-Y, trend)	
11.	**Software for Fracture Test (K_{IC}/J_{IC}):**	**01**
	i. A user-friendly software for conducting fracture toughness (J_{IC}/K_{IC}) tests as per ASTM E 399 and ASTM E 1820 standard. ii. The software should be able to conduct the tests under displacement and COD control. iii. Crack length measurement using both unloading compliance and DCPD systems. iv. In built pre-defined compliance relations for various specimen geometry. v. Provision for replay of data and re-calculation of crack length by changing compliance limits vi. Continuous synchronous data collection on all channels at user defined interval vii. Automatic calculation of J and Δa (delta a), identification of J_Q and J_{IC} viii. Both raw data and processed data should be stored in PC in ASCII or any other transferable form to external spread sheet (eg., Excel), Real time graphic windows (X-Y, trend,)	
12.	**Software for FCGR test**	**01**
	i. A user friendly software for conducting FCGR tests as per ASTM E 647 standard ii. Ability to run FCGR tests under (a) constant load amplitude, (b) decreasing ΔK (delta K) and (c) Constant K_{max} envelopes iii. Crack length measurement using both unloading compliance and DCPD technique iv. In built pre-defined compliance relations for various specimen geometries	

	v. Continuous synchronous data collection on all channels at user defined intervals vi. Automatic calculation of number of cycles, *da/dN*, ΔK, R-ratio vii. Provision for on-the-fly modification of controlling test parameters (ΔK, R-ratio, ΔP, frequency) viii. Both raw data and processed data should be stored in PC in ASCII or any other form suitable for transfer to spread sheet programs like MS Excel ix. Ability to pause and resume a test x. Real time graphic windows (X-Y, trend)	
13.	**User Programmable General purpose software**	**01**
	i. An user programmable multi-purpose software for performing static or dynamic tests employing pre-defined waveforms such as ramp, sine, triangular, trapezoidal, or user defined waveforms in sequential or block loading mode ii. Continuous synchronous data collection on all or selected channels, at linear, logarithmic or on defined change-in-value intervals iii. Provision for collecting both complete cycle data and peak-valley data iv. Data storage in PC in ASCII or any other form suitable for transfer to spread sheet programs like MS Excel v. Ability to pause and resume a test vi. Control on waveform envelope time vii. Real time graphic windows (X-Y, trend)	
14.	**Computer**	**01**
	i. Branded suitable PC (Min RAM 16GB), 2TB storage (minimum) with Keyboard, Mouse, 21" LCD monitor (or larger) for long duration application. Latest Windows OS or better specification (brand, model and specifications to be stated) attached to digital controller. Latest Office suite must be installed for data export and visualisation. Appropriate interface (GPIB/IEEE/Ethernet/USB) card for enabling machine command, control and query	**01**
15.	**UPS/Regulated power supply**	**01**
	UPS cum regulated power supply to run the controller and computer with 30 min back up and provide stabilized power supply to the digital controller	
16	**Safety Protections**	
	i. Bidders should include suitable device for fire source detection and protection for critical parts in gaseous hydrogen ii. Audio- Visual alarm for hydrogen gas leakage iii. Compatible device for fast evacuation system Hydrogen leak detection system with hydrogen sensors in the entire line from the gas supply cylinder to the test setup and auto cut of gas supply	
17.	**Consumable for operating pressure and temperature with gaseous hydrogen atmosphere application**	
	List of necessary spares with their cost should be furnished for smooth operation of the system for 5 years after expiry of the comprehensive warranty	
18.	Spot welding system to be provided, if leads are to be attached to specimens by spot welding	**01**
C	**General Requirements**	
19.	**Manuals, Calibration certificates and Tool kit**	
	i. Manuals (including drawings) for regular maintenance and operation of the system and software(s) should be provided ii. Calibration certificate for all transducers should be provided	

	iii. Design codes and standards used should be supplied iv. Sets of tools required for routine operation and maintenance of the system should be included	
20.	**Installation, Commissioning and Training**	
	i. The system should be supplied, installed, commissioned and demonstrated at the site (CSIR-NML) ii. On-site training for minimum of 4 days for 04 persons	
21.	**Warranty**	
	i. Three years comprehensive warranty including calibration annually and followed by 02 years non-comprehensive AMC which include a) Calibration-01 b) Breakdown maintenance -02 and c) Preventive maintenance -03 annually ii. The warranty should be effective from the date of issue of satisfactory installation & commissioning certificate at the user laboratory/institute iii. AMC cost will be considered during evaluation of price bid. iv. The brought-out items/peripherals for the main system, which consist of warranty beyond three years by the manufacturer, should be transferred in the name of CSIR-NML and will be treated accordingly beyond three years comprehensive warranty period.	
22.	**Eligibility Criteria for Bidders**	
	i. Quotations only from the original manufacturers of the equipment or their authorized agents will be accepted ii. The OEM quoting for the machine should be reputed; having website of their own and the website should show the technical details of servo-electric testing machine and autoclave, suitable for use under high temperature and pressure gaseous hydrogen environment. iii. The bidder should have supplied similar systems (with the accessories such as high temperature CT fixtures, DCPD based crack growth monitoring and testing software for fracture and fatigue crack growth tests) globally. Past purchase, order copies and contact details of existing users should be provided along with the offer.	
23.	**General Terms and Conditions**	
	i. Supplier should ensure the availability of the quoted model against this enquiry until supply. Interim requests to alter the model, even if they are higher versions, will be summarily rejected. ii. The offer should include all technical data/brochure to support the claim. Mere statement without any supporting document is not acceptable and the offer will be rejected. iii. The supplier should indicate technical support service available in India and a minimum guaranteed down time of the equipment once supplied – No judgement could be made based on variable data of different vendors iv. Availability of control system firmware version support for at least 5 years v. Site inspection before the supply and sharing the pre-installation requirements will be the responsibility of the vendor.	
24	**Acceptance Criteria**	
	i. The supplier should successfully demonstrate the LCF and FCGR on ICT specimens under different H_2 gas pressures (max 400 bar) and temperatures (200°C) as per the above technical specifications for running a test at least 24h duration. ii. The supplier should have supplied at least ONE Servo- Electric Test System with High pressure- High Temperature Autoclave for Gaseous Hydrogen atmosphere of equivalent specification in the last 5 years within India or abroad and should produce the original purchase order copies.	

	iii. The system of the asked specification must be readily available for use. Any proposal for design and fabrication of the system as per the asked specification cannot be accepted.	
25	**Scope of CSIR-NML**	
	CSIR-NML will provide the space, electrical supply, water, gases (H_2, N_2, Ar), air conditioning required for the installation of the instrument.	