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)

12.11.2026

CORRIGENDUM

CSIR-NML Tender Reference No.	**NML/PUR/01/AMC/GSR/OTE/DB/26-27**
GEM Bid Number:	**GEM/2026/B/8212590**
Item Name	**MULTI-SPECIMEN K_{IH} SSRT UNDER HIGH PRESSURE HYDROGEN GAS ENVIRONMENT WITH DCPD CRACK MEASURING SYSTEM**

Consequent to the Pre-Bid Conference held on 05.11.2026, the technical specifications of the above referred tender has been revised and are attached at Annexure-I. The bidders are requested to submit their bid based on the revised technical specifications as per Annexure-I.

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

Bid Submission End Date	**25.11.2026 (03.00 PM)**
Bid Opening Date	**26.11.2026 (03.00 PM)**

All other terms and conditions shall remain same.

14/11/26

Stores & Purchase Officer,
CSIR-NML, Jamshedpur

ANNEXURE-I

EQUIPMENT NAME:

MULTI-SPECIMEN K_{IH} SSRT UNDER HIGH PRESSURE HYDROGEN GAS ENVIRONMENT WITH DCPD CRACK MEASURING SYSTEM

Quantity: 1No

Purpose:

- Slow strain rate test (SSRT) system for conducting elevated temperature static and dynamic mechanical tests in high-pressure gaseous hydrogen environment within an autoclave as per ASTM G 129.
- The SSRT should be capable of performing multi specimen (four 1T-CT specimens) in series at constant load or slow extension rate tests and slow cycling for K_{IH} measurement of materials under high-pressure H_2 gas pressure from 1 bar to 400 bar and temperature from room temperature to 200 °C using compact tension (CT) specimens as per ASTM E1681 standard.
- Further load controlled fatigue (tension-tension cycling i.e $R \geq 0$)
- The SSRT load frame should be integrated with a high temperature, high-pressure autoclave and DCPD crack measuring system with all safety features to handle high-pressure gaseous hydrogen.

Detailed specifications of the requirement are given below.

TECHNICAL SPECIFICATIONS

A.	**Multi-specimen (four 1 T-CT specimens) slow strain rate test (SSRT) machine and Controller for Pressurized Hydrogen Atmosphere**		**Qty**
1.	**Load Frame and features**		01
	Fatigue rated load frame, Suitably and sufficiently stiff load frame to test at the maximum load capacity of SSRT with 100kN		
2.	**SSRT Loading Device**		01
	i. 100kN load capacity, fatigue rated ii. Displacement range: 50mm and suitable for loading of four 1T-CT specimens in series iii. Displacement speed : $1x10^{-6}$ mm/s to $5x10^{-2}$ mm/s or wider iv. Cyclic test frequency: ≤ 2 Hz v. Accuracy: 0.5% on full scale, or better vi. Load measurement resolution: 1N or better vii. Strain gauge based, fatigue rated load cell viii. 100kN load cell capacity with cooling arrangement (if necessary) for testing temperature minimum upto 200°C ix. Materials: Parts exposed to hydrogen gas should be made from hydrogen embrittlement resistant stainless steel AISI 316/316L and suitable nickel alloys in accordance with ASME BPVC Sec 8 or any other international standard x. The load frame should be stand alone floor machine and should not need any special base or foundation. There should be vibration dampeners provided at the base of the load frame. xi. The test of other specimens should not be hampered in case of any specimen cracked/failed during the test. The crack growth data of each specimen should be monitored, stored separately using DCPD.		

3.	**Computer based digital control system for SSRT operation**	**01**
	i. Computer based control and setting of load and/or displacement rate/strain rate test parameters 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. Command waveform generator with 32 bit resolution (for sine, triangular, ramp, trapezoidal and square waveforms) for each transducer v. At least 3 digital IO and 3 analogue outputs vi. Specimen protection facility vii. Provision for continuous monitoring and recording of test temperature viii. Availability of control system firmware version support for at least 5 years.	
	B. Attachments and Software	
4.	**<u>Hydrogen Autoclave with protection device for SSRT</u>** **All materials which are in direct contact with hydrogen gas should be compatible to high pressure and temperature gaseous hydrogen**	**01**
	i. Capable to operate and test at gas H_2 pressure from 1 bar to minimum 400 bar ii. Capable of conducting long term tests on specimen from room temperature to at least 200°C and at the pressures mentioned in point no. i iii. The pressure vessel/autoclave heating band should be ATEX rated iv. Programmable PID controller for heating rate and temperature set point v. Computerized pressure and temperature control and monitoring. vi. H_2 gas pressurization and maintained to desired operating/test pressure using by booster pump, and the booster should be compatible to high-pressure H_2 gas. vii. Suitable vacuum pumping system for removing the gases in the piping and test chamber (autoclave) before the main testing gas is pumped. viii. Provision for high pressure feedthrough for accommodating DCPD connections ix. Gas vent and gas inlet valves x. Sufficient Plug ports on autoclave xi. Feedthrough for attaching temperature and pressure sensor xii. The heater should be provided with limit switch/sensor to avoid overheating. xiii. Pressure relief valve or burst disk on autoclave for safe operation and over pressurizing xiv. It should include both audio and visual alarm for over shooting of temperature and pressure; and in that case the system/test immediately should be shut-off automatically including the gas supply. xv. Vent protection for safeguarding the system against hydrogen leakage. xvi. Provision of sensors/safety switches, as the case may be, for gas leak detection and safe cut-off. xvii. Necessary high pressure hoses, fittings etc., for connecting H_2 gas cylinder to autoclave (test chamber) to be included in the offer. xviii. Autoclave/pressure vessel and the material should be complied in accordance with the ASME BPVC Section 8 or any other international standards.	

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	xix. Autoclave manufactured and designed in accordance with international standard and the certificate documents should be provided. **xx.** Easy and safe lid lifting system for handling autoclave lid and SSRT	
5.	**DCPD System suitable for high pressure and temperature with gaseous hydrogen atmosphere application**	**01**
	i. Software controlled DCPD system with voltage amplifier for crack growth measurement of four CT specimens ii. Capability of measurement in both direct-current potential drop and reversed direct-current potential drop modes. iii. DCPD current range: from 0 to 20A or higher iv. Voltage measurement resolution: 100nV or lower v. DCPD unit should be fully integrated with SSRT such that it is ready to use. vi. Simultaneous measurement of all variables (X/Y signals, current, voltage at load) vii. All connections to the specimens should be isolated from each other and the main supply viii. Option for controlling the unit both from control unit of the DCPD system and using software ix. All cables and leads (current input, voltage pickup, interfacing) suitable for conducting FCGR and K_{IH} tests at temperatures from room temperature to minimum 200°C to be provided x. 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 xi. DCPD device should comply requirements as per ASTM E 647/ASTM E1820 xii. Wire feed-through required for 4 CT specimens testing in series. xiii. Wire feed throughs for reference specimen, which is used to compensate the bias due to the temperature, shall be provided.	**01**
6.	**Specimen holders, CT Clevis & Adaptors suitable for high pressure and temperature with gaseous hydrogen atmosphere application**	
	i. 1T CT clevis along with loading pins, capable of being used for tests from room temperature to minimum 200°C. Note: Note: 1T- CT specimen dimension: as per ASTM E399 ii. ½T CT clevis along with loading pins, capable of being used for tests from room temperature to minimum 200°C. Note: ½ T- CT specimen dimension: as per ASTM E399 iii. Additional Adapters/Connecting rods/studs, for attaching both type of CT clevis should be included. iv. Test specimens should be suitably electrically isolated from the machine load frame for use with DCPD system	**2 Pair each** **2 Pair each**
7.	**SSRT and DCPD Software**	**01**
	i. Constant strain rate/constant displacement rate tests, constant load testing. ii. A user-friendly software for conducting load control fatigue tests as per ASTM E 606 standards. iii. Provision for various test end criteria decisions for fatigue tests (cycle based, load based) iv. 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 v. Provision for collecting both complete cycle data and peak-valley data vi. Ability to pause and resume a test vii. Real time graphic windows (X-Y, trend) viii. Continuous synchronous data collection on all or selected channels, at linear, logarithmic or on defined change-in-value intervals ix. Provision for collecting both complete cycle data and peak-valley data x. Ability to pause and resume a test xi. The software should be able to conduct the tests under displacement and COD control. xii. A user friendly software for conducting FCGR tests as per ASTM E 647 standard under different K modes (constant, decreasing and increasing K value) xiii. Automatic calculation of crack size and K xiv. Provision for on-the-fly modification of controlling test parameters (K, load, frequency) xv. Data storage in PC in ASCII or any other form suitable for transfer to spread sheet programs like MS Excel xvi. Real time graphic windows (X-Y, trend) xvii. 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	
8.	**Desktop Computer and Accessories**	**01**
	i. Suitable branded PC with latest MS Windows OS Keyboard, Mouse, 24" or larger LCD dual monitor interface for testing and analysis separately, attached to digital controller for running the SSRT, DCPD etc. software. ii. Latest Office suite must be installed for data export and visualisation. iii. RAM: 32GB, SSD: 1TB, Processor: minimum latest Intel i5 or higher processer or a suitable processror iv. Appropriate interface (GPIB/IEEE/Ethernet/USB etc.) card for enabling machine command, control and query v. Color laser base printer with provision to network application	**01**
9.	**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	
10.	**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 iv. Hydrogen leak detection system with hydrogen sensors in the entire line from the gas supply cylinder to the SSRT. v. All the electrical connectors, heating elements, controllers, etc. where necessary are should be ATEX rated.	
12.	**Spares for high pressure and temperature with gaseous hydrogen atmosphere application**	
	i. Bidders should include all essential spares for smooth operation of system for 5 years. ii. Pins suitable for 1T-CT specimen iii. Pins suitable for ½T-CT specimen	**10** **10**
13.	Spot welding machine suitable for connecting DCPD leads to specimens should be quoted.	**01**

	C. Scope of suppliers	
14.	**Supply, Installation, Commissioning and Training**	
	i. Site inspection prior to the supply of the system and sharing of the pre-installation requirements will be the responsibility of the vendor ii. The system should be installed, commissioned at the site (CSIR-NML) iii. On-site training for minimum of 4 days for 04 persons iv. On site continuous operation of the system for minimum 24hrs should be demonstrated	
15.	**Manuals, Calibration certificates and Tool kit**	
	i. Manuals (including complete original drawings of system) for regular maintenance, servicing 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. On set of necessary tools and tackles are required for routine operation and maintenance of the system should be included	
16.	**Warranty**	
	i. Three years comprehensive warranty including calibration annually and followed by 05 years non-comprehensive AMC prices should be quoted separately which include a) Calibration-01 b) Breakdown maintenance -02 and c) Preventive maintenance -02 annually. The quoted AMC prices would be considered in price bid evaluation. ii. The warranty should be effective from the date of issue of satisfactory installation & commissioning certificate at the user laboratory/institute iii. 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	
17.	**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 thei r own and the website should show the technical details of SSRT testing m achine and autoclave with suitable for high temperature and pressure gaseous hydrogen environment. iii. The bidder should have supplied at least ONE similar systems (with the accessories such as high temperature CT fixtures, DCPD based crack growth monitoring and testing software for slow strain rate test, fracture and fatigue crack growth tests particularly in high-pressure and high-temperature hydrogen gas environment to reputed R&D, industry, academic institutes in India or globally in the last 5 years. Past purchase order copies and contact details of existing users should be provided along with the offer. iv. If the bidder has not supplied similar systems in India/globally but claim to have the capability to manufacture such systems then they should demonstrate the proven capability to the satisfaction of the buyer with documented evidences.	

	v. The supplier providing after sales service, annual maintenance contract an d emergency breakdown service in India will only be considered. vi. If required, user (Academic Institute / Government Research institutes) reviews about the performance of the supplied system and after sales service will be taken and this will be one of the criteria during technical comparison of quotations received and acceptance of the quotation.	
18.	**General Terms and Conditions**	
	i. 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. ii. Supplier should indicate technical support service available in India and the response to address the issue after first intimation should be less than 48 hours. iii. The quotation shall clearly indicate the item wise cost of each individual component, including accessories and spares, wherever applicable and AMC. iv. The bidder should ensure the availability of necessary spares for minimum 10 years after expiry of the comprehensive warranty for the smooth operation of the system.	
19.	**Acceptance Criteria**	
	i. The supplier should successfully demonstrate the K1H tests under constant load and/or under slow cyclic load controlled for 4 CT specimens at H_2 gas pressures (1 atm to minimum 400 bar) and temperatures (room temperature to minimum 200°C) as per the above technical specifications for running a test at least 24h duration. ii. The supplier should successfully demonstrate the leak-tightness of the complete system at maximum specified operating pressure (400 bar) & temperature (200 °C) for a minimum of 24 hours of continuous operation, with no leakage, pressure loss, or abnormal change in system performance.	
	D. Scope of CSIR-NML	
20.	i. CSIR-NML will provide the space, electrical supply, water, gases (H_2, N_2, Ar), air conditioning required for the installation of the instrument.	