TENDER NO. IPR/TN/PUR/TPT/ET/19-20/27 DATED 29/08/2019

COMPLIANCE FORM

Data Sheet to be filled by the vendor

Vendor is requested **not to write only 'complied'** but give proper inputs in the specified column (Vendor's Reply) & submit along with the offer.

Sr. No.	Parameter	IPR Specification	Vendor's Reply
1.	Load cell capacity	50 kN	
2.	Accuracy of load cell	Accuracy, linearity, repeatability, hysteresis and resolution according to ASTM E 4	
3.	Application modes	Cyclic compression and Creep	
4.	Test area-height	Max. approx. 1350 mm ± 50 mm	
5.	Test area-width between drive screws of cross head	approx. 610 mm ± 50 mm	
6.	Rate of loading	Variable from 200 N/min to 10000 N/min	
7.	Test speed range of cross head	minimum 0.00167 mm/min to maximum 100 mm/min	
8.	Crosshead speed accuracy	± 0.1 % or better of set value	
9.	Position control resolution	0.1 µm or better	
10.	Control parameter	Force and/or displacement control	
11.	Loading arrangement	Servo controlled motorized loading system	
12.	Duration of the experiment	100 hrs. (in case of creep) and 200 cycle (in case of Young's modulus)	

COMPLIANCE FORM

13.	Mode of Operations	Auto Mode and Manual Mode	
14.	Power supply	230 volts ± 10 volts	
15.	Safety	Emergency switch and limit switch for up and down	
16.	Material of Construction for both sample holder and pistons (upper and lower)	Inconel 718	
17.	Movement of piston and fixing in machine	The upper piston should be dynamic for the experiment and lower piston should be in static condition. The upper and lower piston fixed/clamped in a way that one can easily replace and assemble with other fixture/piston easily	
18.	Inner diameter of the sample holder	45 mm to 50 mm	
19.	The inner depth of the sample holder	25 ± 1 mm	
20.	Sample holder fastening on bottom piston	The sample holder should be easily fixed on the top of lower piston and the clearance should be minimum so that it will not move here and there during operation while applying load as well as the condition of expansion and contraction must be focused at elevated temperature.	
21.	Measurement of sample temperature	Vendor should supply a K-type thermocouple (Accuracy: Class -1, according to the IEC 60 584-2) to measure temperature of pebble bed.	
22.	Gap between the inner wall of sample	The maximum possible gap which can be maintained between the inner wall of sample holder and wall of upper piston	

COMPLIANCE FORM

	holder and wall of upper piston	during operation at elevated temperature should not be higher than 0.5 mm.	
23.	Furnace type	A cylindrical three zone vertical split tube furnace	
24.	Furnace maximum and continuous operating temperature	Furnace maximum operating temperature and continuous operating temperature should be 1200 °C and 1000 °C, respectively.	
25.	Heating zone dimension	Inner diameter: 95 to 105 mm and Height: 360 ± 10 mm	
26.	Temperature Measurement	3 Nos. of K-type thermocouples for furnace controller. Accuracy: Class -1, according to the IEC 60 584-2.	
27.	Temperature controller	PID Controller with thyristor drive which can program at-least 10 segment with variable ramp and dwell time.	
28.	Heating rate and temperature accuracy	1 to 10 °C/min and ± 5 °C or better.	
29.	Furnace skin temp at 1000 °C	Maximum 60 °C	
30.	Location of Furnace	The furnace should be positioned vertically at the center of the specimen during test and should have the option of moving (up and down) without changing anything in the main machine.	
31.	Temperature display	Digital display of temperatures.	
32.	Vacuum pump type	The vacuum should be attained by a direct driven two stage rotary vane vacuum pump. The vendor should give the make, model and other details of the rotary vacuum pump	

COMPLIANCE FORM

33.	Ultimate vacuum level of the quoted vacuum pump	The ultimate vacuum level of the quoted vacuum pump should be at least $1x10^{-2}$ mbar	
34.	Material of construction for Vacuum chamber	Vacuum chamber should be made of transparent quartz	
35.	Working temperature of quartz tube	The stability of quartz at higher temperature should be above 1000 °C	
36.	The outer diameter of quartz tube	The outer diameter of the quartz tube should be selected by keeping in view of inner diameter of furnace 95 to105 mm so that it could be around 80 to 90 mm (OD)	
37.	Water chiller	Vendor should provide a suitable water chiller to protect O-rings in this offer. Water temperature should be adjusted through digital display control panel. Vendor should also provide the chiller technical details such as cooling capacity, water flow rate, dimensions, water tank capacity, outlet water temperature, power supply, end connections, etc.	
38.	LVDT range, resolution and accuracy	0 - 5 mm or ± 2.5 mm range, resolution of 1 micron and accuracy of 0.1 % or better of full scale output	
39.	LVDT sensitivity	48 mV/V/mm or better	
40.	LVDT required quantity and its positioning	1 Nos. of LVDT should be placed inside the vacuum chamber to access the strain developed in the sample (pebbles) within the sample holder	
41.	LVDT measurement	During experiments any kind of inaccuracy or error produced in the measurement of LVDT due to high temperature and thermal expansion of piston should be taken care by the vendor.	

COMPLIANCE FORM

42.	Data logging rate and resolution	100 Hz or better. Software shall provide provision to extract logged data in the following steps: 1 Hz, 10 Hz and 100 Hz. Resolution: 16-bit or better.	
43.	Software	1. The software should have the facility of different method of testing for cyclic compression and creep experiment. 2. The software should have user programmable loading pattern. 3. The software should have GUI to provide user commands and to monitor the real time data. The data output file shall be MS excel compatible (.csv format). The required output is test time, travel sensor (LVDT sensor), standard travel (crosshead movement), standard force, temperature, vacuum, sample strain and stress.	
44.	Schedule	1. Vendor should submit the drawings of machine as per Sr. No. 45 and details of machine as per Sr. No. 46 within 15 days from the PO. 2. IPR will give the comments/approval within 7 working days after receiving the drawing and details (as described in Sr. No. 45 and Sr. No. 46) from the vendor. But the ultimate performance of the machine will be on the vendor side. To satisfy the ultimate required performance, vendor can contact to IPR to take permission for any modifications or change in the design and drawing of machine. 3. After the approval from IPR, vendor can start the fabrication. 4. Vendor should inform IPR for the FAT/PDI at the vendor/factory site well in advance preferably 15 days before. Vendor need to submit the	

COMPLIANCE FORM

		documents/test reports for satisfying PDI /FAT requirements as mentioned in Sr. No. 47 for the approval before dispatch of machine. 5. The delivery of the machine should be within 3 months from the date of approval of drawing. Vendor should complete the installation and commissioning at IPR within one month. 6. Proper packing should be done for the shifting of instrument from vendor/factory site to IPR.	
45.	Drawings of machine	1. Dimension details of the machine with each individual items 2. Dimension details of the piston and sample holder 3. Positioning of each item in the machine including the controllers 4. LVDT sensor position 5. Thermocouple placement 6. Sample holder locking with the bottom piston 7. Vacuum sealing details	
46.	Details of machine	1. Utility requirements like power supply, total space, etc. 2. Details of furnace 3. Details of heating element, thermocouples and their location 4. Information of material used for construction of machine 5. Details of required water flow rate, inlet temperature, water inlet and outlet connections on the flanges, etc.	
47.	Factory Acceptance Test/Pre dispatch	1. Temperature, vacuum level, cross head speed, load cell, LVDT and data	

COMPLIANCE FORM

	inspection (FAT/PDI):	acquisition system will be tested at Vendor's place. 2. At least 1 hour of holding at 1000 °C of furnace will be done to check the temperature accuracy and heating rate as well during this experiment. 3. Cyclic Compression and Creep experiment will be done with Li_2TiO_3 pebbles (IPR will provide Li_2TiO_3 pebbles for the experiment) 4. Stability of the machine for 50 kN load and stress analysis report 5. Calibration Certificates: a) LVDT along with signal conditioner b) Load cell along with signal conditioner c) Thermocouples d) Cross-head movement of the machine 6. After FAT/PDI, the inspection report will be reviewed by IPR expert committee for its approval. After completing the approval procedure IPR purchase section will issue the dispatch clearance to the vendor.	
48.	Acceptance Test at IPR and Training	1. The instrument along with its all components should be installed and commissioned at IPR by the vendor. 2. Vendor should provide proper training of the instrument to IPR personnel for its operation. 3. The following experiments will be carried out at IPR: a) Temperature, vacuum, cross head speed, load cell, LVDT and data acquisition system will be tested after installation. Temperature accuracy, heating rate etc. will be tested.	

COMPLIANCE FORM

		b) Cyclic Compression and Creep experiments will be carried out with Li_2TiO_3 pebbles.	