ISO 9001 Organisation
सी.एस.आई.आर-संरचनात्मक अभियांत्रिकी अनुसंधान केन्द्र
CSIR-STRUCTURAL ENGINEERING RESEARCH CENTRE
(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद Council of Scientific and Industrial Research)
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CORRIGENDUM - I

(REVISED TECHNICAL SPECIFICATIONS)

Sub: Revised Technical Specification - Supply, Installation, Commissioning, Integration, Training & Documentation of Electrodynamic Shaker System with Climatic Chamber.

Ref: 1. CSIR-SERC Tender Ref. No. A3 (14536)2024/PUR/SERC Dt: 23.07.2025
2. CPPP Tender ID: 2025_CSIR_242345_1 Dt: 23.07.2025

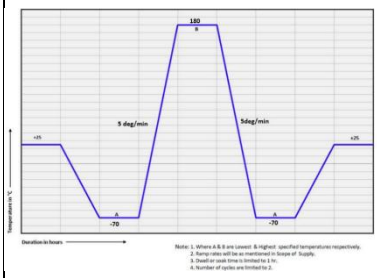
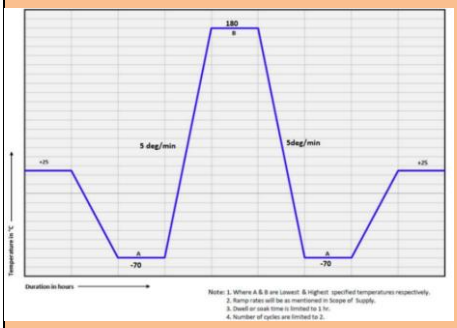
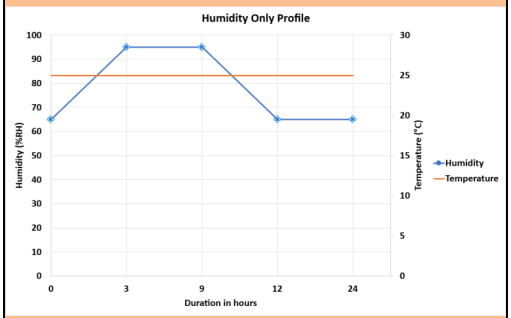
Against our CPPP Tender Notice No. A3 (14536)2024/PUR/SERC Dt: 23.07.2025 w.r.t Supply, Installation, Commissioning, Integration, Training & Documentation of Electrodynamic Shaker System with Climatic Chamber and detailed discussion in the pre-bid meeting which was held on 12.08.2025 @ 11.00 AM, the Competent Committee of CSIR-SERC has recommended the following revised Technical Specifications. The pointwise changes to the specifications are highlighted.

CORRIGENDUM/REVISED SPECIFICATIONS AFTER PBC (Pre- Bid Conference) on 12.8.2025

(Pointwise Changes to the Specifications of the CSIR-SERC Tender Ref. No. A3 (14536)2024/PUR/SERC Dt: 23.07.2025; CPPP Tender ID: 2025_CSIR_242345_1 Dt: 23.07.2025 for Supply, Installation, Commissioning, Integration, Training & Documentation of Electrodynamic Shaker System with Climatic Chamber)

Page No.	Parameters as notified in the tender	SERC Requirements as notified in the tender	Revised SERC Requirements after PBC
Page 45 Section 2.22 Terms of Payment GCC 2.22.1 (Page No. 57)	Payment for Goods and Services supplied from India:	The payment shall be made in Indian Rupees, as follows: 100% Payment will be released after receipt of material in good Condition and Installation, Commissioning, Integration, Training & Documentation of Electrodynamic Shaker System with Climatic Chamber at CSIR-SERC and submission of 5% PBG for the total order value including GST valid for the period of 60 days after warranty period. Note: All payments due under the Contract shall be paid after deduction of statutory levies at source (like ESIC, Income Tax, etc.), wherever applicable.	The payment shall be made in Indian Rupees, as follows: 100% Payment will be released after receipt of material in good Condition and Installation, Commissioning, Integration, Training & Documentation of Electrodynamic Shaker System with Climatic Chamber at CSIR-SERC and submission of 5% PBG for the total order value including GST valid for the period of 60 days after warranty period. or Payment will be 100% and Inland LC can be made but the payment will be made after successful Supply, Installation, Commissioning, Integration, Training & Documentation by way of giving an acceptance certificate by CSIR-SERC. Note: All payments due under the Contract shall be paid after deduction of statutory levies at source (like ESIC, Income Tax, etc.), wherever applicable.
Page No. 62, Section 4.2 Specifications, S. No. 35	Maximum load on the table	≥ 10000 kg	≥ 10000 kg (static)
Page No. 67, Section 4.2 Specifications, S. No. 121	Multichannel Temperature/Humidity	Required and to be supplied by the bidder. With minimum 9 channels.	Required and to be supplied by the bidder. With minimum 9 Channels (8 for temperature and one for humidity)

Page No.	Parameters as notified in the tender	SERC Requirements as notified in the tender	Revised SERC Requirements after PBC
	data logging system		
Page No. 99, Section 4.2 Specifications, S. No. 115	Condenser type	• Water cooled • Preferably stainless brazed plate heat exchanger construction with suitable working pressure for waterside and refrigerant side • All the accessories such as Chiller, pipelines or pump that are required for operating the condenser/ chamber in the specified working range should be listed and supplied by the bidder	• Water cooled • Preferably stainless brazed plate heat exchanger construction with suitable working pressure for waterside and refrigerant side • All the accessories such as Chiller, pipelines or pump that are required for operating the condenser/ chamber in the specified working range should be listed and supplied by the bidder •Distance between the chiller unit and chamber will be minimum 10m
Page No. 62, Section 4.2 Specifications, S. No. 30,	Pitch	350 kN-m or better	300 kN-m or better
Page No. 62, Section 4.2 Specifications, S. No. 31	Yaw	80 kN-m or better	50 kN-m or better
Page No. 96, Section 4.2 Test Specifications, S. No. 94	Vibration Controller Signal Types	The controller should have following signals. • Sine vibration • Random Vibration • Sine on Random(SoR) • Random on Random(RoR) • Sine and Random on Random (SRoR) • Classical Shock • Resonance Search, Track & Dwell • Field Data Replication • Shock Response Spectrum • Transient Time History (TTH) • Sine Tracking, Analysis and Generation • Self-Calibration Software	The controller should have following signals. • Sine vibration • Random Vibration • Sine on Random(SoR) • Random on Random(RoR) • Classical Shock • Resonance Search, Track & Dwell • Field Data Replication • Shock Response Spectrum • Transient Time History (TTH) • Sine Tracking, Analysis and Generation • Self-Calibration Software

Page No.	Parameters as notified in the tender	SERC Requirements as notified in the tender	Revised SERC Requirements after PBC
Page No. 76, Section 4.2 Test Specifications, S. No. 26	Typical load test	Calibration of the chamber with a typical load	Calibration of the chamber with a typical load of 50kg MS
Page No. 76, Section 4.2 Test Specifications, S. No. 28	Test profile	Replicate acceptance test profile for high and low-temperature test as given below; Replicate profile for combined temperature and Humidity test as per the specifications 	Replicate acceptance test profile for high and low-temperature test as given below; Replicate profile for combined temperature and Humidity test as per the specifications  

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) which is hosted in CPP Portal and CSIR-SERC website with CPPP Tender Ref. 2025_CSIR_242345_1 and CSIR-SERC Tender Ref.A3(14536)2024/PUR/SERC. All other terms & Conditions of the tender except the above remain unchanged.

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

Revised Specifications

Eligibility Criteria for Participation in tender

The bidder should have supplied and commissioned the following:

(i) Two numbers of electrodynamic shaker system of similar capacity, out of which one number should be of combined electrodynamic shaker with climatic chamber system

in Govt institutes/ Govt. research organizations/ Public funded Universities/Reputed private industries in India/Abroad in the last 10 years. The bidder should submit the copies of the purchase orders and their installation reports. The installation reports should be of the same purchase orders.

Detailed Specifications for Electrodynamic Shaker with Climatic Chamber

CSIR-SERC is planning to setup a test facility which includes an Electrodynamic Shaker with Climatic Chamber system. The required system includes an electrodynamic shaker, head expander, slip table on a common base with air isolation configurations, power supply amplifier, vibration controller, hydraulic power supply, armature cooling blower with silencer and standard accessories. A climatic chamber and its subsystems that work in tandem with the electrodynamic shaker system are needed to simulate various vibration testing conditions in a controlled environmental condition. The detailed technical specifications for the Electrodynamic Shaker with Climatic Chamber system is as follows:

Technical Specifications for Electrodynamic Shaker

S.No.	Parameters	SERC Requirements
1.	Shaker Type	Electro Dynamic
2.	Sine Force Rating (peak)	≥ 6800 kgf
3.	Random Force Rating (rms.)	≥ 6800 kgf
4.	Shock force	≥ 14000 kgf
5.	Displacement (continuous)	≥ 75 mm (peak to peak, sine)
6.	Velocity of bare table	≥ 1.75 m/sec. peak (sine) ≥ 2 m/sec. peak (shock)
7.	Static Payload support	≥ 800 kg
8.	Max. runtime	24 hours continuous at 80% efficiency
9.	Frequency range	Range Min:≤ 5 Hz Range Max: ≥ 2500 Hz
10.	Sine acceleration (peak) Rated	≥ 75 g
11.	Random acceleration (rms) Rated	≥ 75grms
12.	Type of Cooling	Air-cooled
13.	Total Armature moving mass	≤ 80 kg
14.	Total Armature Diameter	≤ 500 mm
15.	Fundamental Armature Resonance Frequency	> 1600 Hz
16.	Armature Power Requirements (based on current drawn to run shaker at full capacity in sine rating)	≥ 80 kVA
17.	Suspension Cross Axial Stiffness	≥15 kN/mm

S.No.	Parameters	SERC Requirements
18.	Suspension Rotational Stiffness	≥ 150 kNm/rad
19.	Stray Magnetic Field	≤ 1.5 mT
20.	Armature Inserts	Metric coarse threaded, M8 or M10 or M12 type with center, 3",6",12", PCDs. Inserts should be equally spaced.
21.	Auto centering of armature, over travel interlock and geared shaker rotation	Auto centering of the armature for the rated static load should be provided; Armature over travel interlock should trip the power amplifier; Easy rotation of the shaker to 90 deg using manual effort rotation or better.
22.	Armature Suspension	Rolling strut assembly or copper beryllium or carbon-carbon flexures or better.
23.	Air Isolation Trunnion and armature guidance	Required and to be supplied by the bidder
24.	Shaker Cooling unit	The shaker should be provided with air blower with silencer of suitable capacity. The acoustic noise during the cooling unit operation should not exceed 120 dBA at a distance of 1 meter.
SLIP TABLE		
25.	Type	• Common base type: Shaker trunnion and guiding system and slip table, mounted on a common steel structure providing permanent alignment with shaker and slip table • Combo Base Isolation: The shaker unit along with common base should be isolated from floor by the use of air mounts of appropriate capacity. • Oil film guided type or equivalent • Slip plate supported by granite base with oil film and hydrostatic journal bearings or equivalent.
26.	Slip Table Dimension & Material	Minimum 1500mm (L) x 1500mm (W) x 50mm (Thk) Material: Magnesium or equivalent

S.No.	Parameters	SERC Requirements
27.	Slip table mass	<600kg
28.	No of hydrostatic bearings	Minimum 4
29.	Surface Finish	Roughness average ≤ 0.5 micron
30.	Pitch	300 kN-m or better
31.	Yaw	50 kN-m or better
32.	Roll	280 kN-m or better
33.	Flatness	≤0.2mm per meter
34.	Maximum Stroke	Minimum 75 mm
35.	Maximum load on the table	≥ 10000kg (Static)
36.	Useful frequency range of shaker combined with slip table	Range Min: ≤ 5 Hz Range Max: ≥ 2000 Hz
37.	Bare Table resonance	≥ 700 Hz (nominal)
38.	Mounting hole pattern	To be provided. Should be with standard type and grid hole pattern with SS inserts.
39.	Driver Bar	• Tension bolt type • All welded construction
40.	Thermal barrier	Thermal barrier for the slip table is required and to be supplied by the bidder. Thermal barrier material should withstand -80 deg C to +200 deg C. Thermal barrier mass should be ≤ 400 kg
HYDRAULIC POWER SUPPLY		
41.	Hydraulic Power Pack (Reputed Make)	Suitable for the bearing slip table.
42.	Sound Pressure level of Hydraulic Power Pack	≤ 100 dB A at a distance of 1m from the outer periphery of the HPP.
43.	Hydraulic Power Supply	Suitable for the slip table operating at 380-480V AC, 50Hz, 3 Phase
44.	Motor	Fully enclosed, fan-cooled Minimum 1 kW; 50 Hz
45.	Pressure pump	Type Gear; Operating pressure ≥ 150 bar Delivery rate 50 Hz: ≥ 2 liters/min @ 150 bar
46.	Filtration	≤ 15 microns
47.	Oil tank capacity	≥ 30 liters

S.No.	Parameters	SERC Requirements
HEAD EXPANDER		
48.	Type	Table with additional frame for extra load support
49.	Head expander table dimensions	≥ 1500mm x 1500mm with suitable thickness
50.	Head Expander table material	Magnesium alloy or equivalent with standard type and grid hole pattern with SS inserts
51.	Head Expander table mass	≤ 400kg
52.	Useful frequency range	5Hz to 2000Hz or better
53.	Top face flatness tolerance	≤ 0.2 mm/m
54.	Thermal barrier	Thermal barrier for the head expander is required and to be supplied by the bidder. Material should withstand -80 deg C to +200 deg C
AMPLIFIER		
55.	Type of Amplifier	• IGBT or S-MOSFET based switching amplifier of Class D • Modular in construction and scalable architecture
56.	Amplifier Capacity	a) Total capacity shall be suitable to run the shaker a the maximum rated capacity for sine and shock. b) Number of power modules to be specified.
57.	Full Power Bandwidth	Range Min: ≤ 20 Hz Range Max : ≥ 2000 Hz
58.	Frequency response	± 1.5 dB 20 Hz to 2500 Hz or better
59.	Power Range	Minimum 80 kVA. Should be compatible with shaker for sine and shock rating
60.	Rated Output Voltage	100 Vrms Should be compatible with shaker
61.	Input Sensitivity	1 Vrms input for 100Vrms output. Compatible with all reputed make controllers.
62.	Amplifier Efficiency	> 90%

S.No.	Parameters	SERC Requirements
63.	Signal to Noise Ratio	>70 dB
64.	Input Impedance	≥ 10 kΩ
65.	Switching Frequency	>60 kHz
66.	Modulation range	DC to 10 kHz
67.	Total Harmonic Distortion	<1 % when measured with matched resistive load at rated output
68.	Length of the cable between power amplifier and shaker	Minimum 10 meters
69.	Electrical wiring & Mains power	All tropicalized wiring suitable for 415VAC ±10%, 50Hz. 3Phase. Lower tappings for operation at 380VAC to be provided.
70.	Power amplifier acoustic noise level	≤ 80dBA at 1 meter distance from the amplifier.
71.	Protection	Amplifier should have all standard safety interlocks and monitoring. **a) Interlocks** 1) Amplifier Cooling 2) Vibrator Cooling 3) Vibrator Over travel 4) Field Failure 5) Module Over Current 6) Cabinet door open **b) Metering** 1) Amplifier Output Voltage 2) Amplifier Output Current 3) Field Voltage & Current **c) Indication System level** 1) Output over current. 2) Output over voltage. 3) Output short circuit. 4) Output DC fault. 5) Aux power supplies ON 6) Amplifier cooling failure 7) Amplifier over temperature 8) Vibrator cooling 9) Vibrator over travel 10) Vibrator cooling failure 11) Vibrator over temperature 12) Field failure 13) Supply low / high voltage

S.No.	Parameters	SERC Requirements
		14) Cabinet door open 15) Emergency stop
72.	Power module	The power module should have independent cooling unit and RFI Filters.
COOLING SYSTEM		
73.	Type of Cooling	Forced air cooling blower with silencer.
74.	Capacity of the blower	Suitable to the shaker to remove the heat generated efficiently.
DIGITAL VIBRATION CONTROLLER		
75.	No of input & output channels	Min. 8 channels with possibility for future expansion. All simultaneous input. Min 2 output channels.
76.	Resolution for Input channels	Min 24 bit ADC (individual ADC for each input channel)
77.	Input Voltage range	± 10 V (p-p), with input impedance >500 kΩ
78.	Control signal checks	Input over load, open loop, loss of control signal etc.
79.	Input Sensitivity	Programmable: 10-1000mV/g
80.	Input Signal Type/Coupling	AC/DC/IEPE/ICP/ICP+TEDS/GND/Float
81.	TEDS Standards	IEEE 1451.4.2001 or latest version
82.	ICP Power Supply	1mA to 18mA
83.	Input Connector Type	BNC
84.	Signal to noise ratio (Input)	Minimum 100 dB
85.	Cross channel talk (Input)	< -100dB
86.	Harmonic distortion (Input)	Less than 105 dB
87.	Frequency Range	Min DC to 4 kHz or better
88.	Output Channel Resolution	Minimum 24 bit Digital to Analog converter (DAC)
89.	Output Voltage Range	± 10 V (p-p)
90.	Output impedance	<60Ω
91.	Harmonic distortion (output)	< -95 dB
92.	Continuous time domain data recording for Sine, Random, Classical shock & replaying Recorded time data should be	Required in software/ hardware and to be supplied by the bidder

S.No.	Parameters	SERC Requirements
	exportable.	
93.	Vibration Controller Software	Professional type, latest version compatible with latest version of leading OS. License type: Perpetual validity.
94.	Vibration Controller Signal Types	The controller should have following signals. • Sine vibration • Random Vibration • Sine on Random (SoR) • Random on Random (RoR) • Classical Shock • Resonance Search, Track & Dwell • Field Data Replication • Shock Response Spectrum • Transient Time History (TTH) • Sine Tracking, Analysis and Generation • Self-Calibration Software
95.	Controller and control software version & year of launch.	The controller has to be latest model/ version.

Technical Specifications for Environmental/Climatic Chamber

S.No.	Parameters	SERC Requirements
	GENERAL SPECIFICATIONS	
96.	Environmental/ Climatic chamber integrated with electrodynamic shaker	Required. It is the responsibility of the bidder to integrate climatic chamber with the electrodynamic shaker system, along with other components. Required interfacing elements such as Temperature membrane cloth barrier has to be listed and supplied.
97.	Parameters	Temperature, Humidity
98.	Test Space Dimensions & Volume	Dimension: Minimum 2000mm x 2000mm and the dimensions should be compatible with slip table and head expander. Volume: Min 4500 Liters
99.	Temperature Range	-70 to 180 deg C or better
100.	Temperature Fluctuation	≤ ± 1 deg C
101.	Temperature Gradient	≤ 2 deg C
102.	Rate of change of heating	5 deg C per minute Compliance to IEC 60068-3-5 (or equivalent Indian Standard) without load
103.	Rate of change of cooling	5 deg C per minute Compliance to IEC 60068-3-5 (or equivalent Indian Standard) without load
104.	Humidity Range	10% to 95% RH or better
105.	Humidity fluctuation	1% to 3% RH or better
	Test Space Details	
106.	Test Space	• Pre-polished stainless-steel or equivalent • TIG welded seams to ensure vapor tight enclosure. • Double continuous seal rings of silicone rubber shall be mounted on a thermal breaker strip as the gasket to ensure complete sealing
107.	Insulation	Low 'k' factor, high density and non-hygroscopic nature. Asbestos free mineral fiber insulation.
108.	Thickness of insulated	Minimum 75 mm

S.No.	Parameters	SERC Requirements
	material	
109.	Thickness of Inner & outer stainless-steel sheet	Minimum 1.2 mm
110.	Test Space Conditioning	• The air circulation within the chamber shall be as close to laminar ensuring uniform airflow all across the workspace. • The conditioning plenum shall be covered with a removable sheet providing easy access for maintenance
	Heating & Cooling System	
111.	Heating System	• Stainless steel sheathed air heaters to achieve the desired positive set temperature. • The heaters shall be placed in the conditioning plenum such that there is no direct radiation from the heaters onto the test specimen. • Heater outputs shall be controlled for superior stability and control in temperature using suitable relays and thyristors. •
112.	Refrigeration System	• Anti-corrosive components should be used. • The compressor shall be mounted on anti-vibration pads. • Oil return system for protection against oil migration from the compressor, with sight glass to monitor oil level • The heat exchanger coils with Inner grooved copper tubes, finned for maximum heat transfer • The cooling in the chamber shall be accomplished by a cascade system (low stage, high stage). • All the refrigeration components shall be fixed in a separate compartment. The whole area shall be given adequate ventilation to avoid excess heat build-up inside the compartment.
113.	Type of Refrigerant	CFC free; Eco Friendly (Suitable

S.No.	Parameters	SERC Requirements
		refrigerant type to be mentioned, for high and low stage, in case of cascade refrigeration system)
114.	Compressor type	• Low Noise Type Suitable reciprocating low-temperature application compressors, preferably suction gas cooled, capable of operating in the entire temperature envelope. • Compressor should be with suitable oil type (like POE or equivalent) compatible with eco-friendly refrigerants.
115.	Condenser type	• Water cooled • Preferably stainless brazed plate heat exchanger construction with suitable working pressure for waterside and refrigerant side • All the accessories such as Chiller, pipelines or pump that are required for operating the condenser/ chamber in the specified working range should be listed and supplied by the bidder • Distance between the chiller unit and chamber will be minimum 10m
	Humidity System	
116.	Humidification	• A low-pressure droplet free vapor boiler using direct vaporization system or equivalent. Reservoir shall be provided at side of chamber with PU tube quick connector & water level is automatically controlled through water-in solenoid valve.
117.	Dehumidification	• Refrigeration based de- humidification coils. • The desired level of lower humidity shall be achieved by maintaining the precise dew point temperature. • The output shall automatically be activated based on the set point as well as in ramp up mode after a low-temperature cycle.
118.	Climatic Range	Should cover +10 deg C to +85 deg C

S.No.	Parameters	SERC Requirements
119.	DM water tank with water level indicator	Required capacity need to be supplied
	Instrumentation, Controller and Display Unit	
120.	Sensors	All required sensors for measurement and control of temperature, RH etc., should be of reputable make (like Vaisala or equivalent). Mention details
121.	Multichannel Temperature/Humidity data logging system	Required and to be supplied by the bidder. With minimum 9 Channels (8 for temperature and one for humidity)
122.	Remote access/control of the controller from the software for temperature/humidity inputs and changes	Required and to be supplied by the bidder.
123.	Display Unit	• Min 7" • WVGA 800 x 480 LCD 6.1 Display Type or better • Minimum 16M color touch screen type
124.	Instrumentation & Control	• Flame retardant cables shall be used for main and control unit, complying with International or equivalent Indian Standard. • USB provision for fast downloads, Data logging information, • Internal memory for data logging (> 50 GB) • Real Time trend graph to be viewed on the screen (temperature, Humidity versus time) • IP65 protected touch panel/touchscreen • PLC based system or equivalent of reputed make • High-end multi-loop PID controller for simultaneous control of temperature and humidity (like eurotherm or equivalent) • User friendly test programming and test sequence • Instant program profile preview in graphical format • Internal Fault alerts to be displayed on

S.No.	Parameters	SERC Requirements
		the monitor with HELP menu • Fault diagnostics with history • Low water indication for humidity system on the monitor • Power Resumption Modes: In case of a power failure, option of conditional restart based on temperature/ time or continuous • Chamber-shaker interface circuits and interlocks for combined operation.
125.	Test Profiles	• Temperature cycling: Possible to set different temperature profile/cycle. • Humidity Testing: Possible to set different humidity profile/cycle.
126.	Test Standards	• All relevant latest international standards like MIL, JSS, RTCA related to environmental testing and vibration testing. Example MIL-STD- 810F, MIL-STD-2164, JSS 55555, JSS 6625, RTCA-DO-160E etc., All eqivalent Indian Standards as applicable.
	Overall Features	
127.	Viewing Window	• A multi pane insulated window for inspection should be provided with minimum dimensions of 400mmx400mm • Halogen (or equivalent) lighting shall be provided to view the specimen under test.
128.	Front Door	• The door lock should be pull-action type latch clamp or equivalent. • The door shall be fitted with a limit switch and when ajar shall indicate “door open” in the controller and also be interlocked with the air circulation. • The door shall be fitted with heaters to avoid condensation during low temperature cycles
129.	Entry Ports / Port Holes	• 2 Nos with suitable sealing gasket/silicones plugs • 1 Nos on LHS, Min Diameter: 50 mm. • 1 Nos on RHS, Min Diameter: 100

S.No.	Parameters	SERC Requirements
		mm.
130.	External Surface Finish	All exposed parts shall be painted with corrosion-resistant paint
131.	Conditioning Space	• The conditioning space shall be isolated from the test space using a suitable ducting sheet, with easy removal for maintenance. • All allied components such as the air circulation fan, heaters, evaporator, dehumidification and thermostat should be positioned within this space. • There shall be no direct contact to any of these components from the test space
132.	Mounting	• Chamber with conditioning units should be mounted on the rails, capable of manual or motorized movement in the horizontal space. Suitable installation for rails on the test floor should be done by the bidder. • When not in use, the chamber with conditioning space should be movable to a safer distance (minimum 1m clear distance from slip table), away from the shaker/slip table area so as to enable the independent functionality of shaker/slip table.
133.	Trolley or guideways to the Environmental/ Climatic chamber, to move from head expander to slip table. Rigid stand with height adjustable feature/ provision, so that Environmental/ Climatic chamber can be mounted on head expander and on slip table.	• Chamber / test space unit should have motorized movement for integration with armature/ slip table. • Required and to be supplied by the bidder. Temperature membrane cloth barrier or equivalent should be provided for Armature/Head Expander integration and Slip Table integration bottom panel
134.	Overall Dimensions	• Overall dimensions of the Environmental/ Climatic chamber unit, with its weight must be provided • Required railing length and area for movement of overall chamber unit must be marked and provided.
135.	Input Power Supply	• 415V ± 10%, 3 Phase, 50 Hz

S.No.	Parameters	SERC Requirements
136.	Noise level	< 90 dB
137.	Safety and Maintenance Features	All necessary safeties for electrical, vacuum, hydraulic systems (if any) are to be incorporated to ensure protection to both system & operator against malfunction. The system must be designed for easy maintenance and accessibility to electrical & other components.
138.	Provision for independent operation of Environmental/ Climatic chamber	• Bottom closure plate with dead load capacity of 200 kg (minimum) must be supplied for independent operation of the Environmental/ Climatic chamber • Necessary accessories for independent operation shall be listed and supplied • Minimum 4 numbers of racks with provision for height adjustment • Each rack should have a bearing capacity of Minimum 100kgs
139.	Accessories & others	• Adjustable and removable shelves • O & M (Operation & Maintenance) manual. • Detailed Service manual. • Any special tools required for routine/ preventive & Breakdown maintenance. • All Relevant Software with manuals for control, operation and maintenance. • Necessary cables and connectors for interfacing with PC. • Chamber calibration certificate and detailed procedure for recommended routine calibration. • It is the responsibility of the supplier/ bidder/OEM to include all the essential accessories required for proper functioning of the Environmental/ Climatic chamber at CSIR-SERC. List of accessories to be given.
140.	Water lines, tubing, erection of lines, refrigeration lines/ tubing/ erection,	Supply and installation in scope of the bidder.

S.No.	Parameters	SERC Requirements
	electrical cable/cabling, erection of lines. Refrigeration tanks, any storage tanks. Trolley/Racks, Desiccant humidifier	

Other Requirements

S.No	Parameters	SERC Requirements
	Computer Specifications	
141.	Preferred Make	Reputed Make
142.	Processor	Intel Core i910900X3.7GHz 2933MHz 10C165WCPU or better
143.	RAM	32GB nECC, DDR42933MHz memory support to 256GB; Total 8 DIMM Slots or better
144.	Hard Disk	1TBM.22280 PCle NVMe TLC Solid State Drive &1TB SATA7200RPM HDD. Option for future expansion of additional up to 4SATA/SSD Hard drives or better
145.	Graphics Card	NVIDIA Quadro P2200 5 GB GDDRS dedicated or RadeonProW5500 or better
146.	Keyboard and Mouse	Minimum USB Keyboard and USB Optical Scroll Mouse of reputed make
147.	Audio	High-Definition Integrated Audio with internal Speaker
148.	Operating System	Windows Professional- latest version with MS Office preinstalled (Perpetual license validity). Bidders should ensure all the software are compatible with the controller provided
149.	Warranty for Desktop	1 year Minimum from the date of commission and installation of the whole system
150.	Display	Minimum 27 inch FHD Monitor IPS with LED backlight of reputed make

S.No	Parameters	SERC Requirements
	Others	
151.	List of deliverables	List of deliverables to meet the functional requirements
152.	Utility requirements	Bidder should provide details of the utilities required for operation of the shaker system & Environmental/ Climatic chamber like power requirements, compressed air requirements, space requirements, overall dimension
153.	Documentation (Two sets of Hard Copies in English). Backup copies of all software's and O.S should be supplied in CDROM / pen drive.	• Operation Manual • Service Manual • Electrical wiring and mechanical schematics, dimensional drawings • Parts list: System specifications including subsystems, subsystems data sheets, interface requirements, calibration requirements and procedures. • Factory acceptance test results.
154.	Installation and commissioning	The bidder or their representative should take full responsibility for unloading, unpacking, installation, commissioning, carrying out site acceptance tests and handing over the system to CSIR-SERC. All components not explicitly listed but required for installation must be listed and included in the quotation, failing which they will be considered as included and must be supplied at no additional cost.
155.	Integration of Electrodynamic shaker controller and the Environmental/ Climatic Chamber	The bidder or their representative should take full responsibility of integrating electrodynamic shaker controller with the Environmental/ Climatic chamber at CSIR-SERC. All the components not listed but required during the installation

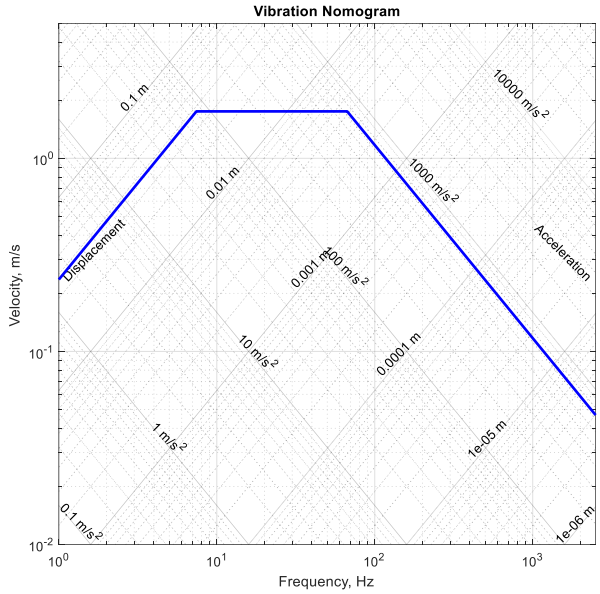
S.No	Parameters	SERC Requirements	
		must be quoted.	
156.	Training at CSIR-SERC	Bidder should provide mandatory in-person training and demonstration on operation and routine maintenance of the system for Minimum 1 week to CSIR-SERC staff (Min. 15 people) as part of installation and commissioning.	
157.	Warranty for Electrodynamic shaker System, controller, Environmental/ Climatic chamber and their sub systems, accessories including its third party items/products.	One-year comprehensive on-site warranty for the complete system including all the equipment, sub systems etc. from the date of installation and acceptance of the system. All spare parts required for the trouble-free operation of the complete system during standard warranty period, needs to be supplied by the bidder, without extra cost. Fault should be resolved on-site within 2 working days of fault reporting.	
158.	Requirement of AMC for the period of 3 years after the expiry of warranty period.	AMC is also required for the maintenance of the complete system including hardware, software, third party items, components etc. after the expiry of warranty period.	
	Note: The bidder should necessarily quote separately for the AMC as detailed below: But, CSIR-SERC will avail the service towards AMC at its discretion. The quoted charges towards AMC will be considered for the evaluation of the bids.		
	Details of Years after the warranty period	**Charges towards AMC**	**Remarks**
	1st year		
	2nd year		
	3rd year		
159.	Spare parts and service support	The quoted system should have a minimum product life cycle of 15 years. The OEM has to inform the CSIR-SERC,	

S.No	Parameters	SERC Requirements
		one year before discontinuing the model/product. The OEM has to provide spare parts and service support for minimum 10 years from the date of discontinuing the model/system.
160.	Testing and Acceptance at CSIR-SERC	Bidder shall conduct acceptance testing of the shaker and chamber system after installation at CSIR-SERC as per the criteria given in Annexure-A.
161.	Schematic drawing	Schematic diagram of quoted shaker and environmental/ climatic chamber assembly with insert configuration shall be provided along with the quote.
162.	Supplied software and hardware	All the listed software and hardware items that bidder quotes should be a proven catalogue product
163.	OEM authorization certificate	If the bidder is not OEM, the OEM authorization certificate has to be submitted along with bidding documents.
164.	Compliance Statement	The bidder should meet all the technical specifications to qualify the bid. The bidder has to furnish the values/units/parameters against each CSIR-SERC requirement in the compliance sheet. Offer without this information will be rejected without any further reference. Merely stating, “comply” does not constitute sufficient information. Exact numerical values are to be specified wherever applicable. Specified technical data should be supported by product catalogues, manuals, test procedures, and test plots etc, along with page number reference to the specified values. In case of insufficient technical data, the quote is liable to be rejected without further intimation. The bidder has to sign and

S.No	Parameters	SERC Requirements
		stamp (company seal) on all the pages of compliance sheet.
165.	List of Installations	The bidder should submit a list of these installations giving details of commissioning & contact details along with the quote. Offer without this information is liable to be rejected without any further reference.

ANNEXURE-A: Criteria for testing and acceptance at CSIR-SERC

S.No.	Parameters	SERC Requirements
	BARE	
1.	Resonance test (Pre-signature)	1g Constant control. Frequency 5 Hz to 2500 Hz at 1 Oct/min. Control at center of armature. Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Plot response accelerations for all three axes at locations. Plot Drive, O/P current, and O/P voltage.
2.	Operation at Maximum rated parameter	Max displacement, Max Velocity and Max Acceleration With frequency 5 Hz to 2500 Hz at sweep rate of 1 Oct/min, Multi point maximal Control at the armature top, Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Plot response accelerations for all three axes at locations. Plot Drive, O/P current, and O/P voltage. Envelope plot given below.

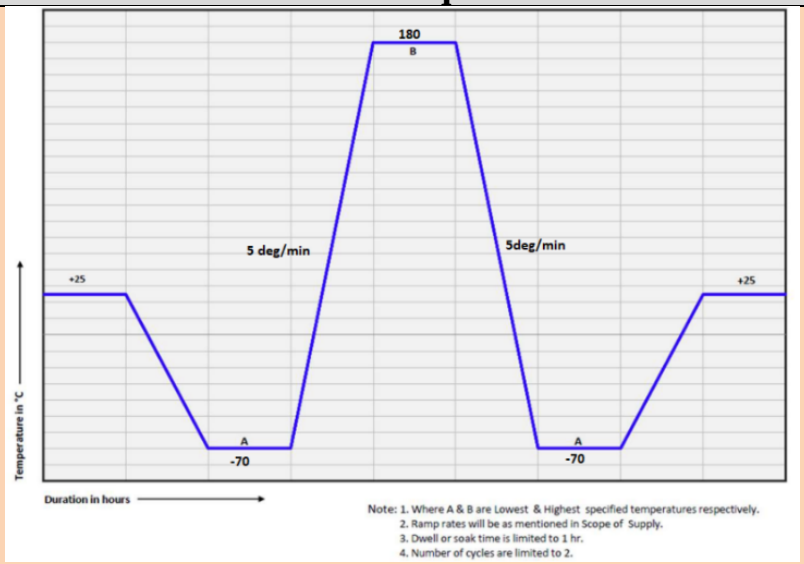
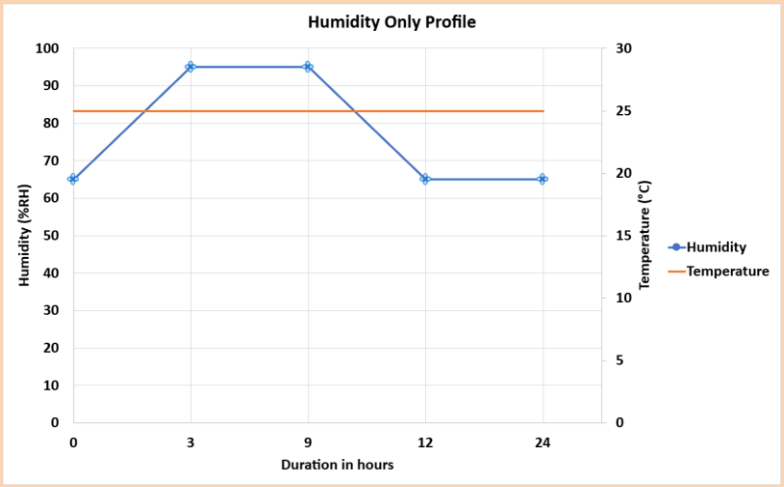
S.No.	Parameters	SERC Requirements
		
3.	Resonance test (Post signature)	1g Constant control. Frequency 5 Hz to 2500 Hz at 1 Oct/min. Control at center of armature. Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Plot response accelerations for all three axes at locations. Plot Drive, O/P current, and O/P voltage.
4.	Diaphragming and Cross axis response test	5g Constant control from 5 to 2500 Hz with required slopes for Displacement and velocity, with sweep rate of 1 Oct/min. Control at center of armature. Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Plot response accelerations for all three axes at locations. Plot Drive, O/P current, and O/P voltage.
5.	Noise measurement on armature top	With amplifier Set to 100% gain and zero input signal Measure accelerometer output at the armature top for 5 Hz to 20kHz analysis range. (Expected level< 0.2g)
6.	Low g sine test	Constant input acceleration level of 0.3g Frequency 5 Hz to 2500 Hz at 1 Oct/min. Control at center of armature. Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Plot response accelerations for all three axes at locations.

S.No.	Parameters	SERC Requirements
		Plot Drive, O/P current, and O/P voltage.
7.	Random rating test	(20-100Hz:6dB/Oct, 100-2500Hz: flat PSD to obtain the max rms acceleration) Multi point maximal Control at armature top Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Plot response accelerations for all three axes at locations. Plot Drive, O/P current, and O/P voltage.
8.	Low g -rms random test	Flat PSD from 20 Hz to 2500 Hz 0.3grms test level. Control at center of armature. Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Plot response accelerations for all three axes at locations. Plot Drive, O/P current, and O/P voltage.
9.	Shock Test	50 g, 10 ms half sine with 10% pre & post pulse control at armature center Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Plot response accelerations for all three axes at locations. Plot Drive, O/P current, and O/P voltage
10.	Resonance test (Post signature)	1g Constant control. Frequency 5 Hz to 2500 Hz at 1 Oct/min. Control at center of armature. Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Plot response accelerations for all three axes at locations. Plot Drive, O/P current, and O/P voltage.
11.	Wave form distortion tests	With input of 1g between 5 Hz to 100 Hz The THD should be ≤10% between 5Hz – 100Hz THD computation should be carried as per ISO
	LOAD TEST (With payload mass 2 times weight of armature, to be arranged by Bidder)	
12.	Resonance test (Pre signature)	1g Constant control. Frequency 5 Hz to 2000 Hz at 1 Oct/min. Control at center of armature. Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions

S.No.	Parameters	SERC Requirements
		Plot response accelerations for all three axes at locations. Plot Drive, O/P current, and O/P voltage.
13.	Sine test	Max displacement, max velocity and max acceleration to achieve max sine force rating of the shaker. Multi point maximal Control Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Frequency 5 Hz to 2000 Hz at 1 Oct/ min. Plot Drive, O/P current, and O/P voltage. Check waveform distortion of accelerometer output and Amplifier output using Digital data acquisition system. Acceleration limited to maximum force rating of shaker.
14.	Random test	20-100Hz: 6dB/Oct, 100-2000Hz: flat PSD for full random force rating. Multi-point maximal Control Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Plot acceleration, Drive, O/P current and O/P voltage.
15.	Endurance test	Shaker should run continuously for 1 hour with maximum displacement, maximum velocity, Acceleration limited to maximum force rating of shaker. Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Multi point maximal Control. Plot acceleration, Drive, O/P current and O/P voltage.
16.	Resonance test (Post signature)	1g Constant control. Frequency 5 Hz to 2000 Hz at 1 Oct/min. Control at center of armature. Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Plot response accelerations for all three axes at locations. Plot Drive, O/P current, and O/P voltage.
	SLIP TABLE	
17.	Resonance test (Pre signature)	1g Constant control. Frequency 5 Hz to 2000 Hz at 1 Oct/min. Control at slip table end along shaker axis

S.No.	Parameters	SERC Requirements
		Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Plot response accelerations for all three axes at locations. Plot Drive, O/P current, and O/P voltage.
18.	Operation at Maximum rated parameter	Max displacement, Max Velocity and Max Acceleration with frequency 5 Hz to 2000 Hz at sweep rate of 1 Oct/min. Control at slip table end along shaker axis Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Plot response accelerations for all three axes at locations. Plot Drive, O/P current, and O/P voltage.
19.	Cross-axis response test	5g Constant control from 5 to 2000 Hz with required slopes for Displacement and velocity Control at slip table end along shaker axis. Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Plot response accelerations for all three axes at locations.
20.	Resonance test (Post signature)	1g Constant control. Frequency 5 Hz to 2000 Hz at 1 Oct/min. Control at slip table end along shaker axis. Measurement at four points in outer most PCD/grid point 90^0 apart along mutually perpendicular directions Plot response accelerations for all three axes at locations. Plot Drive, O/P current, and O/P voltage.
	POWER AMPLIFIER	
21.	Noise measurement	Bare table With amplifier Set to 100% gain and zero input signal Measurement of output voltage and current with input shorted and amplifier set to 100% gain
22.	Wave form distortion tests	**Test-A** With an acceleration of 1g on armature bare table top between 5 Hz to 100Hz record output voltage and current wave forms. **Test-B** Record output voltage and current waveforms for

S.No.	Parameters	SERC Requirements
		• Maximum displacement sine dwell • Maximum velocity sine dwell • Maximum acceleration sine dwell
23.	Shaker system interlocks	Over travel limit ; Cooling unit flow switch; Temperature switch; Field power supply; Abort switches
	ENVIRONMENTAL/ CLIMATIC CHAMBER	
24.	Tolerance	Check has to be done to know whether the Environmental/ Climatic chamber achieves and maintains the required condition within specified tolerance limits
25.	Humidity and temp. measurement	-70^0C to $+180^0$C & 10% to 95% RH
26.	Typical load test	Calibration of the chamber with a typical load of 50kg MS
27.	Repeatability	Demonstrate repeatability of conditions (temperature and humidity) in the chamber during the test
28.	Test profile	Replicate acceptance test profile for high and low-temperature test as given below; Replicate profile for combined temperature and Humidity test as per the specifications

S.No.	Parameters	SERC Requirements
		 

ANNEXURE – VII

REVISED TECHNICAL COMPLIANCE STATEMENT FORM/DEVIATION STATEMENT FORM

S.No.	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
166.	Shaker Type	Electro Dynamic			
167.	Sine Force Rating (peak)	≥ 6800 kgf			
168.	Random Force Rating (rms.)	≥ 6800 kgf			
169.	Shock force	≥ 14000 kgf			
170.	Displacement (continuous)	≥ 75 mm (peak to peak, sine)			
171.	Velocity of bare table	≥ 1.75 m/sec. peak (sine) ≥ 2 m/sec. peak (shock)			
172.	Static Payload support	≥ 800 kg			
173.	Max. runtime	24 hours continuous at 80% efficiency			
174.	Frequency range	Range Min:≤ 5 Hz Range Max: ≥ 2500 Hz			
175.	Sine acceleration (peak) Rated	≥ 75 g			
176.	Random acceleration (rms) Rated	≥ 75grms			
177.	Type of Cooling	Air-cooled			
178.	Total Armature moving mass	≤ 80 kg			
179.	Total Armature Diameter	≤ 500 mm			
180.	Fundamental Armature Resonance Frequency	> 1600 Hz			
181.	Armature Power Requirements (based on current drawn to run shaker at full capacity in sine rating)	≥ 80 kVA			
182.	Suspension Cross Axial Stiffness	≥15 kN/mm			
183.	Suspension Rotational Stiffness	≥ 150 kNm/rad			
184.	Stray Magnetic Field	≤ 1.5 mT			
185.	Armature Inserts	Metric coarse threaded, M8 or M10 or M12 type with center, 3",6",12", PCDs. Inserts should be equally spaced.			
186.	Auto centering of armature, over travel interlock and geared shaker rotation	Auto centering of the armature for the rated static load should be provided; Armature over travel interlock should trip the power amplifier; Easy rotation of the shaker to 90 deg using manual effort rotation or better.			

S.No.	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
187.	Armature Suspension	Rolling strut assembly or copper beryllium or carbon-carbon flexures or better.			
188.	Air Isolation Trunnion and armature guidance	Required and to be supplied by the bidder			
189.	Shaker Cooling unit	The shaker should be provided with air blower with silencer of suitable capacity. The acoustic noise during the cooling unit operation should not exceed 120 dBA at a distance of 1 meter.			
SLIP TABLE					
190.	Type	• Common base type: Shaker trunnion and guiding system and slip table, mounted on a common steel structure providing permanent alignment with shaker and slip table • Combo Base Isolation: The shaker unit along with common base should be isolated from floor by the use of air mounts of appropriate capacity. • Oil film guided type or equivalent • Slip plate supported by granite base with oil film and hydrostatic journal bearings or equivalent.			
191.	Slip Table Dimension & Material	Minimum 1500mm (L) x 1500mm (W) x 50mm (Thk) Material: Magnesium or equivalent			
192.	Slip table mass	<600kg			
193.	No of hydrostatic bearings	Minimum 4			
194.	Surface Finish	Roughness average ≤ 0.5 micron			
195.	Pitch	300 kN-m or better			
196.	Yaw	50 kN-m or better			
197.	Roll	280 kN-m or better			
198.	Flatness	≤0.2mm per meter			
199.	Maximum Stroke	Minimum 75 mm			
200.	Maximum load on the table	≥ 10000kg			
201.	Useful frequency range of shaker combined with slip	Range Min: ≤ 5 Hz Range Max: ≥ 2000 Hz			

S.No.	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
	table				
202.	Bare Table resonance	≥ 700 Hz (nominal)			
203.	Mounting hole pattern	To be provided. Should be with standard type and grid hole pattern with SS inserts.			
204.	Driver Bar	• Tension bolt type • All welded construction			
205.	Thermal barrier	Thermal barrier for the slip table is required and to be supplied by the bidder. Thermal barrier material should withstand -80 deg C to +200 deg C. Thermal barrier mass should be ≤ 400 kg			
HYDRAULIC POWER SUPPLY					
206.	Hydraulic Power Pack (Reputed Make)	Suitable for the bearing slip table.			
207.	Sound Pressure level of Hydraulic Power Pack	≤ 100 dB A at a distance of 1m from the outer periphery of the HPP.			
208.	Hydraulic Power Supply	Suitable for the slip table operating at 380-480V AC, 50Hz, 3 Phase			
209.	Motor	Fully enclosed, fan-cooled Minimum 1 kW; 50 Hz			
210.	Pressure pump	Type Gear; Operating pressure ≥ 150 bar Delivery rate 50 Hz: ≥ 2 liters/min @ 150 bar			
211.	Filtration	≤ 15 microns			
212.	Oil tank capacity	≥ 30 liters			
HEAD EXPANDER					
213.	Type	Table with additional frame for extra load support			
214.	Head expander table dimensions	≥ 1500mm x 1500mm with suitable thickness			
215.	Head Expander table material	Magnesium alloy or equivalent with standard type and grid hole pattern with SS inserts			
216.	Head Expander table mass	≤ 400kg			
217.	Useful frequency range	5Hz to 2000Hz or better			
218.	Top face flatness tolerance	≤ 0.2 mm/m			
219.	Thermal barrier	Thermal barrier for the head expander is required and to be supplied by the bidder. Material should withstand -80			

S.No.	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
		deg C to +200 deg C			
AMPLIFIER					
220.	Type of Amplifier	• IGBT or S-MOSFET based switching amplifier of Class D • Modular in construction and scalable architecture			
221.	Amplifier Capacity	a) Total capacity shall be suitable to run the shaker a the maximum rated capacity for sine and shock. b) Number of power modules to be specified.			
222.	Full Power Bandwidth	Range Min: ≤ 20 Hz Range Max : ≥ 2000 Hz			
223.	Frequency response	± 1.5 dB 20 Hz to 2500 Hz or better			
224.	Power Range	Minimum 80 kVA. Should be compatible with shaker for sine and shock rating			
225.	Rated Output Voltage	100 Vrms Should be compatible with shaker			
226.	Input Sensitivity	1 Vrms input for 100Vrms output. Compatible with all reputed make controllers.			
227.	Amplifier Efficiency	> 90%			
228.	Signal to Noise Ratio	>70 dB			
229.	Input Impedance	≥ 10 kΩ			
230.	Switching Frequency	>60 kHz			
231.	Modulation range	DC to 10 kHz			
232.	Total Harmonic Distortion	<1 % when measured with matched resistive load at rated output			
233.	Length of the cable between power amplifier and shaker	Minimum 10 meters			
234.	Electrical wiring & Mains power	All tropicalized wiring suitable for 415VAC ±10%, 50Hz. 3Phase. Lower tappings for operation at 380VAC to be provided.			
235.	Power amplifier acoustic noise level	≤ 80dBA at 1 meter distance from the amplifier.			
236.	Protection	Amplifier should have all standard safety interlocks and monitoring.			

S.No.	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
		d) Interlocks 7) Amplifier Cooling 8) Vibrator Cooling 9) Vibrator Over travel 10) Field Failure 11) Module Over Current 12) Cabinet door open **e) Metering** 4) Amplifier Output Voltage 5) Amplifier Output Current 6) Field Voltage & Current **f) Indication System level** 16) Output over current. 17) Output over voltage. 18) Output short circuit. 19) Output DC fault. 20) Aux power supplies ON 21) Amplifier cooling failure 22) Amplifier over temperature 23) Vibrator cooling 24) Vibrator over travel 25) Vibrator cooling failure 26) Vibrator over temperature 27) Field failure 28) Supply low / high voltage 29) Cabinet door open 30) Emergency stop			
237.	Power module	The power module should have independent cooling unit and RFI Filters.			
COOLING SYSTEM					
238.	Type of Cooling	Forced air cooling blower with silencer.			
239.	Capacity of the blower	Suitable to the shaker to remove the heat generated efficiently.			
DIGITAL VIBRATION CONTROLLER					
240.	No of input & output channels	Min. 8 channels with possibility for future expansion. All simultaneous input. Min 2 output channels.			
241.	Resolution for Input channels	Min 24 bit ADC (individual ADC for each input channel)			
242.	Input Voltage range	± 10 V (p-p), with input impedance >500 kΩ			
243.	Control signal checks	Input over load, open loop, loss of control signal etc.			
244.	Input Sensitivity	Programmable: 10-1000mV/g			
245.	Input Signal Type/Coupling	AC/DC/IEPE/ICP/ICP+TEDS /GND/Float			
246.	TEDS Standards	IEEE 1451.4.2001 or latest			

S.No.	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
		version			
247.	ICP Power Supply	1mA to 18mA			
248.	Input Connector Type	BNC			
249.	Signal to noise ratio (Input)	Minimum 100 dB			
250.	Cross channel talk (Input)	< -100dB			
251.	Harmonic distortion (Input)	Less than 105 dB			
252.	Frequency Range	Min DC to 4 kHz or better			
253.	Output Channel Resolution	Minimum 24 bit Digital to Analog converter (DAC)			
254.	Output Voltage Range	± 10 V (p-p)			
255.	Output impedance	<60Ω			
256.	Harmonic distortion (output)	< -95 dB			
257.	Continuous time domain data recording for Sine, Random, Classical shock & replaying Recorded time data should be exportable.	Required in software/ hardware and to be supplied by the bidder			
258.	Vibration Controller Software	Professional type, latest version compatible with latest version of leading OS. License type: Perpetual validity.			
259.	Vibration Controller Signal Types	The controller should have following signals. • Sine vibration • Random Vibration • Sine on Random (SoR) • Random on Random (RoR) • Classical Shock • Resonance Search, Track & Dwell • Field Data Replication • Shock Response Spectrum • Transient Time History (TTH) • Sine Tracking, Analysis and Generation • Self-Calibration Software			
260.	Controller and control software version & year of launch.	The controller has to be latest model/ version.			

S.No.	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
	GENERAL SPECIFICATIONS FOR ENVIRONMENTAL/CLIMATIC CHAMBER				
261.	Environmental/ Climatic chamber integrated with electrodynamic shaker	Required. It is the responsibility of the bidder to integrate climatic chamber with the electrodynamic shaker system, along with other components. Required interfacing elements such as Temperature membrane cloth barrier has to be listed and supplied.			
262.	Parameters	Temperature, Humidity			
263.	Test Space Dimensions & Volume	Dimension: Minimum 2000mm x 2000mm and the dimensions should be compatible with slip table and head expander. Volume: Min 4500 Liters	.		
264.	Temperature Range	-70 to 180 deg C or better			
265.	Temperature Fluctuation	≤ ± 1 deg C			
266.	Temperature Gradient	≤ 2 deg C			
267.	Rate of change of heating	5 deg C per minute Compliance to IEC 60068-3-5 (or equivalent Indian Standard) without load			
268.	Rate of change of cooling	5 deg C per minute Compliance to IEC 60068-3-5 (or equivalent Indian Standard) without load			
269.	Humidity Range	10% to 95% RH or better			
270.	Humidity fluctuation	1% to 3% RH or better			
	Test Space Details				
271.	Test Space	• Pre-polished stainless-steel or equivalent • TIG welded seams to ensure vapor tight enclosure. • Double continuous seal rings of silicone rubber shall be mounted on a thermal breaker strip as the gasket to ensure complete sealing			
272.	Insulation	Low 'k' factor, high density and non-hygroscopic nature. Asbestos free mineral fiber insulation.			

S.No.	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
273.	Thickness of insulated material	Minimum 75 mm			
274.	Thickness of Inner & outer stainless-steel sheet	Minimum 1.2 mm			
275.	Test Space Conditioning	• The air circulation within the chamber shall be as close to laminar ensuring uniform airflow all across the workspace. • The conditioning plenum shall be covered with a removable sheet providing easy access for maintenance			
	Heating & Cooling System				
276.	Heating System	• Stainless steel sheathed air heaters to achieve the desired positive set temperature. • The heaters shall be placed in the conditioning plenum such that there is no direct radiation from the heaters onto the test specimen. • Heater outputs shall be controlled for superior stability and control in temperature using suitable relays and thyristors. •			
277.	Refrigeration System	• Anti-corrosive components should be used. • The compressor shall be mounted on anti-vibration pads. • Oil return system for protection against oil migration from the compressor, with sight glass to monitor oil level • The heat exchanger coils with Inner grooved copper tubes, finned for			

S.No.	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
		maximum heat transfer • The cooling in the chamber shall be accomplished by a cascade system (low stage, high stage). • All the refrigeration components shall be fixed in a separate compartment. The whole area shall be given adequate ventilation to avoid excess heat build-up inside the compartment.			
278.	Type of Refrigerant	CFC free; Eco Friendly (Suitable refrigerant type to be mentioned, for high and low stage, in case of cascade refrigeration system)			
279.	Compressor type	• Low Noise Type Suitable reciprocating low-temperature application compressors, preferably suction gas cooled, capable of operating in the entire temperature envelope. • Compressor should be with suitable oil type (like POE or equivalent) compatible with eco-friendly refrigerants.			
280.	Condenser type	• Water cooled • Preferably stainless brazed plate heat exchanger construction with suitable working pressure for waterside and refrigerant side • All the accessories such as Chiller, pipelines or pump that are required for operating the condenser/ chamber in the specified working range should be listed and supplied by the			

S.No.	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
		bidder • Distance between the chiller unit and chamber will be minimum 10m			
	Humidity System				
281.	Humidification	• A low-pressure droplet free vapor boiler using direct vaporization system or equivalent. Reservoir shall be provided at side of chamber with PU tube quick connector & water level is automatically controlled through water-in solenoid valve.			
282.	Dehumidification	• Refrigeration based de-humidification coils. • The desired level of lower humidity shall be achieved by maintaining the precise dew point temperature. • The output shall automatically be activated based on the set point as well as in ramp up mode after a low-temperature cycle.			
283.	Climatic Range	Should cover +10 deg C to +85 deg C			
284.	DM water tank with water level indicator	Required capacity need to be supplied			
	Instrumentation, Controller and Display Unit				
285.	Sensors	All required sensors for measurement and control of temperature, RH etc., should be of reputable make (like Vaisala or equivalent). Mention details			
286.	Multichannel Temperature/Humidity data logging system	Required and to be supplied by the bidder. With minimum 9 Channels (8 for temperature and one for humidity)			
287.	Remote access/control of the controller from the software for temperature/humidity inputs and changes	Required and to be supplied by the bidder.			

S.No.	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
288.	Display Unit	• Min 7" • WVGA 800 x 480 LCD 6.1 Display Type or better Minimum 16M color touch screen type			
289.	Instrumentation & Control	• Flame retardant cables shall be used for main and control unit, complying with International or equivalent Indian Standard. • USB provision for fast downloads, Data logging information, • Internal memory for data logging (> 50 GB) • Real Time trend graph to be viewed on the screen (temperature, Humidity versus time) • IP65 protected touch panel/touchscreen • PLC based system or equivalent of reputed make • High-end multi-loop PID controller for simultaneous control of temperature and humidity (like eurotherm or equivalent) • User friendly test programming and test sequence • Instant program profile preview in graphical format • Internal Fault alerts to be displayed on the monitor with HELP menu • Fault diagnostics with history • Low water indication for humidity system on the			

S.No.	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
		monitor • Power Resumption Modes: In case of a power failure, option of conditional restart based on temperature/ time or continuous Chamber-shaker interface circuits and interlocks for combined operation.			
290.	Test Profiles	• Temperature cycling: Possible to set different temperature profile/cycle. • Humidity Testing: Possible to set different humidity profile/cycle.			
291.	Test Standards	• All relevant latest international standards like MIL, JSS, RTCA related to environmental testing and vibration testing. Example MIL-STD- 810F, MIL-STD-2164, JSS 55555, JSS 6625, RTCA-DO-160E etc., All eqivalent Indian Standards as applicable.			
	Overall Features				
292.	Viewing Window	• A multi pane insulated window for inspection should be provided with minimum dimensions of 400mmx400mm • Halogen (or equivalent) lighting shall be provided to view the specimen under test.			
293.	Front Door	• The door lock should be pull-action type latch clamp or equivalent. • The door shall be fitted with a limit switch and when ajar shall indicate “door open” in the controller and also be interlocked with the air circulation. • The door shall be fitted			

S.No.	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
		with heaters to avoid condensation during low temperature cycles			
294.	Entry Ports / Port Holes	• 2 Nos with suitable sealing gasket/silicones plugs • 1 Nos on LHS, Min Diameter: 50 mm. 1 Nos on RHS, Min Diameter: 100 mm.			
295.	External Surface Finish	All exposed parts shall be painted with corrosion-resistant paint			
296.	Conditioning Space	• The conditioning space shall be isolated from the test space using a suitable ducting sheet, with easy removal for maintenance. • All allied components such as the air circulation fan, heaters, evaporator, dehumidification and thermostat should be positioned within this space. • There shall be no direct contact to any of these components from the test space			
297.	Mounting	• Chamber with conditioning units should be mounted on the rails, capable of manual or motorized movement in the horizontal space. Suitable installation for rails on the test floor should be done by the bidder. • When not in use, the chamber with conditioning space should be movable to a safer distance (minimum 1m clear distance from slip table), away from the shaker/slip table area			

S.No.	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
		so as to enable the independent functionality of shaker/slip table.			
298.	Trolley or guideways to the Environmental/ Climatic chamber, to move from head expander to slip table. Rigid stand with height adjustable feature/ provision, so that Environmental/ Climatic chamber can be mounted on head expander and on slip table.	• Chamber / test space unit should have motorized movement for integration with armature/ slip table. Required and to be supplied by the bidder. Temperature membrane cloth barrier or equivalent should be provided for Armature/Head Expander integration and Slip Table integration bottom panel			
299.	Overall Dimensions	• Overall dimensions of the Environmental/ Climatic chamber unit, with its weight must be provided • Required railing length and area for movement of overall chamber unit must be marked and provided.			
300.	Input Power Supply	• 415V ± 10%, 3 Phase, 50 Hz			
301.	Noise level	< 90 dB			
302.	Safety and Maintenance Features	All necessary safeties for electrical, vacuum, hydraulic systems (if any) are to be incorporated to ensure protection to both system & operator against malfunction. The system must be designed for easy maintenance and accessibility to electrical & other components.			
303.	Provision for independent operation of Environmental/ Climatic chamber	• Bottom closure plate with dead load capacity of 200 kg (minimum) must be supplied for independent operation of the Environmental/ Climatic chamber			

S.No.	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
		• Necessary accessories for independent operation shall be listed and supplied • Minimum 4 numbers of racks with provision for height adjustment Each rack should have a bearing capacity of Minimum 100kgs			
304.	Accessories & others	• Adjustable and removable shelves • O & M (Operation & Maintenance) manual. • Detailed Service manual. • Any special tools required for routine/ preventive & Breakdown maintenance. • All Relevant Software with manuals for control, operation and maintenance. • Necessary cables and connectors for interfacing with PC. • Chamber calibration certificate and detailed procedure for recommended routine calibration. • It is the responsibility of the supplier/ bidder/OEM to include all the essential accessories required for proper functioning of the Environmental/ Climatic chamber at CSIR-SERC. List of accessories to be given.			
305.	Water lines, tubing, erection of lines, refrigeration lines/ tubing/ erection, electrical cable/cabling, erection of lines. Refrigeration tanks, any storage tanks. Trolley/Racks, Desiccant humidifier	Supply and installation in scope of the bidder.			

Other Requirements

S.No	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
	Computer Specifications				
306.	Preferred Make	Reputed Make			
307.	Processor	Intel Core i910900X3.7GHz 2933MHz 10C165WCPU or better			
308.	RAM	32GB nECC, DDR42933MHz memory support to 256GB; Total 8 DIMM Slots or better			
309.	Hard Disk	1TBM.22280 PCle NVMe TLC Solid State Drive &1TB SATA7200RPM HDD. Option for future expansion of additional up to 4SATA/SSD Hard drives or better			
310.	Graphics Card	NVIDIA Quadro P2200 5 GB GDDRS dedicated or RadeonProW5500 or better			
311.	Keyboard and Mouse	Minimum USB Keyboard and USB Optical Scroll Mouse of reputed make			
312.	Audio	High-Definition Integrated Audio with internal Speaker			
313.	Operating System	Windows Professional-latest version with MS Office preinstalled (Perpetual license validity). Bidders should ensure all the software are compatible with the controller provided			
314.	Warranty for Desktop	1 year Minimum from the date of commission and installation of the whole system			
315.	Display	Minimum 27 inch FHD Monitor IPS with LED backlight of reputed make			
	Others				
316.	List of deliverables	List of deliverables to meet the functional requirements			
317.	Utility requirements	Bidder should provide details of the utilities required for operation of the shaker system &			

S.No	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
		Environmental/ Climatic chamber like power requirements, compressed air requirements, space requirements, overall dimension			
318.	Documentation (Two sets of Hard Copies in English). Backup copies of all software's and O.S should be supplied in CDROM / pen drive.	• Operation Manual • Service Manual • Electrical wiring and mechanical schematics, dimensional drawings • Parts list: System specifications including subsystems, subsystems data sheets, interface requirements, calibration requirements and procedures. • Factory acceptance test results.			
319.	Installation and commissioning	The bidder or their representative should take full responsibility for unloading, unpacking, installation, commissioning, carrying out site acceptance tests and handing over the system to CSIR-SERC. All components not explicitly listed but required for installation must be listed and included in the quotation, failing which they will be considered as included and must be supplied at no additional cost.			
320.	Integration of Electrodynamic shaker controller and the Environmental/ Climatic Chamber	The bidder or their representative should take full responsibility of integrating electrodynamic shaker controller with the Environmental/ Climatic chamber at CSIR-SERC. All the components not listed but required during the installation must be quoted.			

S.No	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
321.	Training at CSIR-SERC	Bidder should provide mandatory in-person training and demonstration on operation and routine maintenance of the system for Minimum 1 week to CSIR-SERC staff (Min. 15 people) as part of installation and commissioning.			
322.	Warranty for Electrodynamic shaker System, controller, Environmental/ Climatic chamber and their sub systems, accessories including its third party items/products.	One-year comprehensive on-site warranty for the complete system including all the equipment, sub systems etc. from the date of installation and acceptance of the system. All spare parts required for the trouble-free operation of the complete system during standard warranty period, needs to be supplied by the bidder, without extra cost. Fault should be resolved on-site within 2 working days of fault reporting.			
323.	Requirement of AMC for the period of 3 years after the expiry of warranty period.	AMC is also required for the maintenance of the complete system including hardware, software, third party items, components etc. after the expiry of warranty period.			

Note: The bidder should necessarily quote separately for the AMC as detailed below:
But, CSIR-SERC will avail the service towards AMC at its discretion. The quoted charges towards AMC will be considered for the evaluation of the bids.

Details of Years after the warranty period	Charges towards AMC	Remarks
1st year		
2nd year		
3rd year		

S.No	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
324.	Spare parts and service support	The quoted system should have a minimum product life cycle of 15 years. The OEM has to inform the CSIR-SERC, one year before discontinuing the model/product. The OEM has to provide spare parts and service support for minimum 10 years from the date of discontinuing the model/system.			
325.	Testing and Acceptance at CSIR-SERC	Bidder shall conduct acceptance testing of the shaker and chamber system after installation at CSIR-SERC as per the criteria given in Annexure-A.			
326.	Schematic drawing	Schematic diagram of quoted shaker and environmental/ climatic chamber assembly with insert configuration shall be provided along with the quote.			
327.	Supplied software and hardware	All the listed software and hardware items that bidder quotes should be a proven catalogue product			
328.	OEM authorization certificate	If the bidder is not OEM, the OEM authorization certificate has to be submitted along with bidding documents.			
329.	Compliance Statement	The bidder should meet all the technical specifications to qualify the bid. The bidder has to furnish the values/units/parameters against each CSIR-SERC requirement in the compliance sheet. Offer without this information will be rejected without any further reference. Merely stating, “comply” does not constitute sufficient information. Exact numerical values are to be specified wherever			

S.No	Parameters	SERC Requirements	Offered Specification	Compliance (Yes/No)	Reference in the technical document
		applicable. Specified technical data should be supported by product catalogues, manuals, test procedures, and test plots etc, along with page number reference to the specified values. In case of insufficient technical data, the quote is liable to be rejected without further intimation. The bidder has to sign and stamp (company seal) on all the pages of compliance sheet.			
330.	List of Installations	The bidder should submit a list of these installations giving details of commissioning & contact details along with the quote. Offer without this information is liable to be rejected without any further reference.			