



May 13th, 2024

To Whom It May Concern

Limited local Tender for repurposing of an existing cleanroom at CCT, IISc by modifying/upgrading the existing Utilities.

This tender is in continuation with the EOI towards “Modification/Upgrade of Existing Utility system for Cleanroom facility” dated: 04/08/2022 and only vendors who were qualified in the same will be eligible to participate.

This is an RFQ (Request for Quote) for repurposing an existing cleanroom at CCT, IISc by modifying/upgrading the existing utilities as part of a local tender for the Centre for Nano Science and Engineering (CeNSE) at IISc, Bangalore.

CeNSE is a multidisciplinary research department at IISc that houses a 14,000 sq. ft. cleanroom and characterization facility used by 50 faculty members from various disciplines at IISc. CeNSE also runs a program called Indian Nanoelectronics Users Program (INUP) which has allowed 4200 participants from more than 700 universities and institutes all over India to use the facilities at CeNSE. Consequently, any tool in CeNSE receives significant exposure to scientific community at IISc and beyond. The vendors are requested to factor in the value of this exposure in to their quotes. Details of existing facilities and INUP program can be gleaned from:

<http://nnfc.cense.iisc.ac.in/>
<http://www.mncf.cense.iisc.ac.in/>
<https://www.inup.cense.iisc.ac.in/>

Also, CeNSE hosts equipment on behalf of vendors, as a national standard or ‘model’ system. If the vendor is interested, CeNSE can consider working out a similar arrangement for the DRIE system.

Procedure

1. Vendors will be required to submit a technical proposal and a commercial proposal in **two separate sealed envelopes**. Only vendors who meet the technical requirements will be considered for the commercial negotiation. **PLEASE MAKE SURE THE SITE VISIT IS DONE BEFORE SUBMITTING THE BID. ONLY BIDS FROM VENDORS WHO HAVE VISITED THE SITE WILL BE ENTERTAINED.**
2. **The deadline for submission of proposals is the 3rd June 2024, 5:30 pm Indian Standard Time.** Proposals should arrive at the Main office, GF-15, Centre for Nano Science and Engineering, Indian Institute of Science, Bangalore 560012, India, by the above deadline.
3. The decision of the purchase committee will be final.
4. The quote should come only from an Indian Original Equipment Manufacturer (OEM) or their Indian authorized distributor.
5. The quotations should be on FOR-IISc Bangalore basis in INR only.



6. MSMEs can seek an exemption to some qualification criteria. IISc follows GFR2017 for such details.
7. The Bidder should belong to either class 1 or class 2 supplier distinguished by their “local content” as defined by recent edits to GFR. They should mention clearly which class they belong to in the cover letter and should provide all the required supporting documents.
 - a) Class 1 supplier: Goods and services should have local content of equal to or more than 50%.
 - b) Class 2 supplier: Goods and services should have local content of equal to or more than 20 % and less than 50%).
5. Bidders offering imported products will fall under the category of non-local suppliers. They cannot claim themselves as Class-1 local suppliers/Class-2 local suppliers by claiming the services such as transportation, insurance, installation, commissioning, training, and other sales service support like AMC/CMC, etc., as local value addition.
6. Purchase preference as defined by the recent edits to GFR (within the “margin of purchase preference”) will be given to Class-1 supplier.
7. The technical proposal should contain a compliance table with 5 columns. The first column must list the technical requirements, in the order that they are given in the technical configuration below. The second column should describe your compliance in a “Yes” or “No” response. If “No” the third column should provide the extent of the deviation (please provide quantitative responses). The fourth column should state the reasons for the deviation, if any. The fourth column should also contain the make and model of the components/parts to be used in the installation.
8. Any additional capabilities or technical details, that you would like to bring to the attention of the purchase committee, can be listed at the end of the technical table.
9. In the commercial bid, please provide itemized cost of the different subsystems, along with possible breakups.
10. Please indicate the warranty provided for the systems. A warranty of 1 year from the date of handover of the cleanroom will be mandatory.
11. Provide itemized cost for *required* spares for 2 years of operation. Please note, the cleanroom is expected to be operational 24x7 and breakdowns should be minimal or nil.
12. As an additional option, provide cost of an annual maintenance contract (AMC) for 1 year, post warranty. The AMC must cover 1 scheduled and 1 emergency visit per year. The AMC cost must also include an itemized list of spares that are essential for the scheduled visits.
13. The RFQ must include references of 3 previous installations, preferable in India. Please provide the names and contact addresses of the referees, so that the committee can contact them independently.
14. Any questions can be directed to Mr. Gajendra M, Centre for Nano Science and Engineering, Indian Institute of Science, Bangalore 560012, India. (gajendram@iisc.ac.in)

The overview of cleanroom required specifications along with the tool list and its utility requirements are given below:



List of Qualified vendor based on the EOI towards “Modification/Upgrade of Existing Utility system for Cleanroom facility” dated: 04/08/2022.

1. Nano clean technologies.
2. UHP Technologies Pvt Ltd.
3. Axenic Systems.
4. CGA air tech Pvt Ltd.

Facility Overview:

The Cleanroom area will comprise a suite of Class 100, and Class 1000 Cleanrooms and Utility Support Areas

- 1) Class 1000 Area
- 2) Class 100 Area
- 3) Change Room
- 4) Utility Rooms for Electrical and Gases
- 5) Cleanroom HVAC
- 6) Cleanroom utilities:
 - i) Process Cooling System
 - ii) DI Water System
 - iii) Bulk Gas Distribution
 - iv) Process Exhaust System
- 7) Ultra-High Purity Gas Lines
- 8) Cleanroom and HVAC Electrical
- 9) Building Management System (BMS)
- 10) Scrubbing Systems
- 11) Life Safety and Security System
- 12) Testing Commissioning and Validation

Cleanroom Parameter Control Philosophy

The clean room parameters will be controlled automatically by BMS. The output from all the sensors will be taken to the BMS. Based on the sensor inputs, BMS will give commands to different systems (VFD, Modulating Valves, and Heater) to modulate and control the clean room parameters.



Cleanroom Specifications

Parameter	Class 1000	Class 100	Change Room: Class 10000
Room Area in m ²	76.79	10	7
Room Height in m	2.5	2.5	2.5
Temperature in °C	21±2	21±2	22±2
RH in %	50±5	45±5	50±5
Room Positive Pressure	15-20 Pa	25-30 Pa	5-10 Pa
Air Flow pattern	Vertical	Vertical	Vertical
Sound level	45±5 db	45±5 db	45±5 db
Light Intensity	500 Lux normal Light	400-450 Lux UV Light	500 Lux normal Light
Process Exhaust	3000 CMH	1000 CMH	NA



Summary of Cleanroom Equipment with Utility Requirements

Sl No	Tool	Power in KVA		PCW @ 18 °C 5 barg	CDA @7 barg	Gas in LPM						Exhaust In CMH	DI water in lpm
		1φ	3φ			in LPM	in LPM	N2	Ar	O2	C4F8		
1	MJB4	3.5		0	2	1	0					180	0
2	Optical microscope	1		0	0	0	0					0	0
3	Furnace		28	30	5	20	5	5				350	0
4	Wet chemical bench 1	1		0	2	5	0					1080	5
5	Wet chemical bench 2	1		0	2	5	0					1080	5
6	Litho Wet bench	1		0	2	5	0					1080	5
7	RIE		28	30	50	20	1	1	1	1	1	120	0
8	Sputter		30	35	5	10	1					20	0
9	E-beam evaporator		30	35	5	10	1					20	0
10	SEM		10	10	5	5						10	0
11	AFM	3.5		0	5	2						0	0
12	Probe station 1	2		0	2	2						0	0
13	Probe station 2	2		0	2	2						0	0
14	Refrigerator	1		0	0	0						0	0
15	spin coater with vacuum pump	1											

Sl NO	Specification
1	CLEANROOM CONSTRUCTION
1.1	<p>Cleanroom Solid Wall Panel for Class 1000</p> <p>Supplying & Fixing of Progressive type Solid Double skin modular 100mm thick Solid wall panel for partitions and wall panelling, made of 0.8 mm thick Powder coated sheets on both sides with PUF as infill of density $40 \pm 2 \text{ kg/m}^3$, GI Profiles for reinforcement along the periphery with bottom track, and necessary arrangements, All Joints shall be sealed with cleanroom compatible Neutral Grade Silicon Sealant.</p> <p>The existing wall panels and ceiling panels should be utilized.</p>
1.2	<p>Cleanroom Return Air Riser Wall Panel for Class 1000</p> <p>Cleanroom Return Air Riser wall panel with inbuilt Return Air Risers of not less than 0.8 mm thick Powder coated GI sheet (hot dipped with zinc coating of 120 gsm), Return air risers shall be minimum 800x70mm to be provided with a minimum of 15mm puff insulation on both side of riser, within the wall panel. Risers with adjacent ceiling heights to extend minimum 200mm high above the top of the false ceiling with minimum 25mm flange.</p>
1.3	<p>Cleanroom Ceiling Panel for Class 1000</p> <p>Cleanroom Ceiling panels shall be Progressive type Double skin modular 75 mm thick Ceiling wall panel made of 0.8 mm thick Powder coated sheets on both sides with PUF as infill of density $40 \pm 2 \text{ kg/m}^3$, GI Profiles for reinforcement along the periphery with bottom Aluminium track, and necessary arrangements, All Joints shall be sealed with cleanroom compatible Neutral Grade Silicon Sealant.</p> <p>Ceiling panels are suspended by threaded tension bars with adjustable turnbuckles fastened to the overhead support at fixed intervals to withstand 150-200 Kg per sq. mtr.</p>
1.4	<p>Cutout in Wall & Ceiling Panels</p> <p>Suitable factory-made cut-outs wherever required shall be provided in the wall panel and ceiling panel as applicable for fixing HEPA filters with Modules, light fixture, return air grills, power sockets, communication outlets, LAN outlets, cables, pipes, exhaust ducts, Magnehelic gauge, smoke sensors, pendants, utilities etc., are also to be included in the quotation after conducting an inspection to the proposed clean room and utility.</p> <p>Factory made wall cut-outs for switches and sockets and includes one conduit per cut-out. Quantity and size as per requirement. Quantity will be as per the Electrical design and will be finalized on drawing approval.</p> <p>Factory made ceiling cut-out for HEPA Modules (with lip as per HVAC design). Quantity and size as per requirement. Quantity will be as per the HVAC design and will be finalized on drawing approval. Each 0.74 SQM (1200 mm X 600 mm).</p> <p>Factory made ceiling cut-out for Light Fixtures (with lip as per electrical design). Quantity and size as per requirement. Quantity will be as per the Electrical design and will be finalized on drawing approval. Each 0.36 SQM (600 mm X 600 mm)</p>
1.5	Clean room Window Modules

	Windows and door vision panels should be formed from double glazed toughened glass composite modules. View panels of size 900 x 900 mm shall be provided in wall panels - View panels glass shall be at least 5 mm thick toughened Glass with Ceramic border of 20mm width. View panels shall be fixed flush to both faces of wall panels. - No crevices / joints/sloped profiles should be used for fixing the glass to avoid particle contamination and dust accumulation.
1.6	<p>Clean room Doors</p> <p>Clean room Doors shall be 44 mm thick doors flush on one side made of static-dissipative type powder coated door frames 1.2mm thick totally flushed with the wall panels - Concealed hardware for fixing the door frames. - In fill of PUF/ Honeycomb is used to give the effective acoustic and thermal insulation.</p> <p>Stainless steel double bearing butt hinges as per BS 7352 CLASS 9 - Mortise dead locks with all ancillaries like door closer, lock & key, hinges, d-handle, push plate, drop seal & tower bolt with view glass of size 0.4m x 0.6m. Door-sets should match the partition modules.</p>
1.7	<p>Coving</p> <p>All the Covings (Inner and Outer Coving) are Extruded Aluminium Powder Coated /Anodized clip-on type covings of R-50mm. Coving shall be used at wall-wall and wall-ceiling joints and Wall to Floor. Coving Corner Pieces: All the Inner and Outer 3D & 2D corner pieces are Aluminium powder coated finish.</p>
1.8	<p>ESD Flooring</p> <p>The electrostatic dissipative flooring should be provided for Cleanroom Class 100 & 1000 areas with the specification below: -</p> <ul style="list-style-type: none"> • The anti-static floor material shall have a Resistance level of 1×10^9 ohms • Load carrying capacity of the material shall be 750PSI (min.) conforming to BS 2050. • The joints shall be welded by thermo chord weld. • The flooring shall Include providing and laying (P/L) suitable copper strip (foil) grid of size 3' x 3' (approx.) as recommended by manufacturer and connecting to the dedicated earthing <p>Work includes preparation of existing surface with suitable (compatible for clean room application) floor levelling material so as to make the surface free from any undulations</p>
1.9	<p>Dedicated Earthing for ESD Flooring</p> <p>ESD Flooring includes, dedicated earth pit accessories and Interconnecting Copper strip 30x5 mm thick.</p> <p>Vendor has to ensure 0.1 ohm resistance can be achieved at the cleanroom point.</p>
1.10	<p>Cleanroom lights</p> <p>Class 1000 Lights</p> <p>Cleanroom compatible LED lights. The envisaged Lighting level in clean rooms is 500 Lux, at 90 cm above the floor. Lights must be openable towards inside the room. Dimensions: 600 x 600 mm Power: 42 W</p>

	<p>Class 100 Light Cleanroom teardrop light fittings for ISO 5 (class 100) and surface mounted fittings to be provided throughout the facility to achieve the 400-450 Lux lighting levels. The teardrop & surface mounted light fittings shall comprise of a powder coated extruded aluminum body and clear acrylic diffusers. UV filtration film having 350-400 nm thickness to be applied on lights or UV Tube sleeves shall be used</p>
<p>1.11</p>	<p>HEPA filter HEPA filter module The Clean Room ceiling system shall include HEPA filter ceiling modules as indicated on the drawing.</p> <ul style="list-style-type: none"> · The filters will be used as terminal air distribution device. The air supply plenum shall be connected directly to a connecting collar on the filter top with individual damper in the plenum and flexible ducts. · The filters shall H13 class filters as per EN1822 with an efficiency of 99.95%. · The design Air velocity through filter shall be 0.45m/s with IPD of 100±5% Pa or better. · The frame of the filter shall be of Extruded Anodized Aluminium construction. · The filter media shall be Glass Fibre with hot melt separator. · The filter shall have expanded sheet metal face guard. The face guard shall be powder coated in off-white colour. · The filter shall be having endless polyurethane D-profile, Liquid pour to solid in extrusion profile seal at the outlet. · All the filters shall be individually tested according to EN1822 and computerized scan test report should accompany each filter. · The filter shall be held in place utilizing ‘hold down’ devices with the Ceiling grid using channel on the filter top and T-bolts in the ceiling grid pressing the filter against ceiling grid. · All filter modules shall be complete with air inlet collar of 12” diameter (approx.). · Top sheet should be of G.I./Aluminium single piece drawn with seamless neck. In case, neck is not seamless, neck joint to the top sheet be a proper leak proof joint and with the capability of supporting a person standing on the top surface. · Filter media shall be bonded to extruded aluminium cell sides. <p>Dimensions :1210 L x 600 D x 60 mm H</p>

	<p>Fan Filter Units Fan Filter module with HEPA filters. These FFM's are self-powered grid module with modular design, to fitting in standard T grid ceiling. Total height is 320mm. The Fan Filter Module is U.L listed and CE certified. FFU speed can vary from 0.2 to 0.5m/s and air flow rate vary from 460-760 CFM. The sound level will be 55dB's when measured from 760mm below from filter face. The vibration level is 0.9mils.The Fan motor drive will be direct drive, forward curve centrifugal type with sealed bearing. The motor will have permanent split capacitor type, rated for continuous operation with thermal overload protection with two speed switches. The power requirement is 230V, 50Hz single phase with maximum current of 1.9A with 280watts power input. The fan/motor assembly is capable of delivering air at filter pressure of 9mm to 23mm final state. These FFM will have a speed controller for increasing the speed of the motor/blower from low, medium and high. Dimensions :1215 Lx 600 D x 350 mm HFFU Material of construction: Al Zinc AlloyULPA filter: Ulpa Filters U15 are rated 99.9995% efficiency in removing 0.3µ or larger particles. IPD of 120±5% Pa or better. Leak free in accordance with latest I.E.S recommended particle. The filter media is micro glass fibre with poly-string separator, sealed to casing. The filter guard is provided with diamond pattern expanded sheet for protection. Dimensions :1210 L x 600 D x 60 mm HPre Filter are rated 90% efficiency in removing 10 to 15 micron particles. Pre filters are made from non-woven materials.Dimensions :550 L x 600 D x 50 mm H</p>
1.12	<p>Air Shower Supply of Single-entry air shower *Material of Construction: Powder Coated SS304 * Dimensions:1500mm L x 1500mm D x 2300mm H *Class 100 Compatible *Door interlocking arrangement should permit opening of only one door at a time. During operation, neither entrance nor exit door should be operated. A lock switch for overriding the electronic control system ensuring manual operation should also be provided. *The air shower shall be provided with per filter of HDPE, Washable type with efficiency 90% down to 10 micron and HEPA filter with efficiency of 99.97% down to 0.3 microns etc., *Air Shower shall include: Differential Pressure Gauge, ON/OFF Switches, PAO Test Port, Timer for setting Air Shower operation time (settable for 30 seconds to 5 minutes), Emergency STOP button, Automatic as well as Manual Working.</p>
2	<p>Air handling unit</p>
2.1	<p>AIR HANDLING UNIT (AHU) (Quantity – 1 No.s) 1) Specification of the AHU for class 1000 clean room is given below: a. Total Supply air = 6.169 M3/sec (Vendor should give their calculation) b. Return air =4.175 m3/sec (Vendor should give their calculation) c. Fresh air =1.994 m3/sec (Vendor should give their calculation) d. Total fan Static =150 mm WG (Vendor should give their calculation) e. Cooling Coil Capacity =60 Tr f. Heater capacity= Kw</p>



	g. Humidification Capacity: 5 Kg/Hr
2.2	<p>AHU CASING</p> <p>1) AHU shall be of modular construction and of draw through type comprising of pre filter section, fine filter section, cooling coil section and fan section. The framework shall be of extruded Al sections joined by moulded high tensile reinforced plastic and shall be assembled to provide a sturdy, strong and self-supporting framework for various sections. Each section shall be complete with its own independent base and mounted on 14G galvanised sheet steel and aluminium die cast channels. Zinc deposition on the GI sheets shall be minimum 120 gsm.</p> <p>2) AHU shall be of double skin, with 45+5 mm thick PUF insulation sand-witched panel, 0.8 mm thick percolated GSS outer skin and 0.8 mm thick plain GSS sheet inside. The density of PUF insulation shall be minimum 38±1 Kg/m³.</p> <p>3) The framework for each section shall be joined together with soft rubber gasket in between to make joints air tight.</p> <p>4) Suitable air tight access doors with Aluminium die cast heavy duty hinges and locks shall be provided for various sections.</p> <p>5) The casing shall incorporate thermal break profile and all other necessary design. Features to ensure that condensation does not occur during all seasons.</p> <p>6) The AHUs shall be having Sound attenuators at Suction and delivery of AHUs to reduce the sound to 70±2 dB</p>
2.3	<p>CIRCULATION FAN</p> <p>1) Fan Type: Direct driven, Plug type high efficiency centrifugal fan</p> <p>2) Desired noise level should be reduced to 70±5 dB or less by suitable sound attenuators on supply and return air path.</p> <p>3) Required Total static pressure: 150 ± 2 mm WG.</p> <p>4) Fans should have backward curved blades to improve efficiency.</p> <p>5) Fan blades should be made of Aluminium alloy for stability.</p> <p>6) Motor and fan assembly should be floor mounted and to be placed on extruded aluminium sections and on the vibration isolators to reduce amplitude to less than 25-50 microns.</p> <p>7) Motor Requirement: Adequately sized, TEFC Squirrel cage induction motor with VFD drive and suitable for 415V ± 10%, 3 phase, 50 Hz± 5% AC power supply.</p> <p>8) The motor should be of high efficiency IE3 class as per IS 12615 – 2011- Non FLP.</p> <p>9) Motor should be compatible for VFD operation.</p> <p>10) Flexible connection should be fabricated of neoprene coated flame proof fabric attached by screws or bolts at 6” interval should be provided. Flexible connection should be provided with the sufficient material width to prevent interference with the free operation of the fan vibration system.</p> <p>11) Fan should be factory statically and dynamically balanced as required to achieve field balance levels.</p> <p>12) Epoxy based coating shall be provided on all the surfaces of ferrous fan housing.</p>



	<p>13) Vibration measurement should be made in three orthogonal areas at each bearing location. Where equipment configuration precludes measurement at bearing, measurement should be made on adjacent routine structure.</p> <p>14) Peak to peak displacement at the rotational frequency should be measured. Governing displacement should be at the rotational frequency of fan. Controlling displacements at frequencies other than the rotational frequencies are not in compliance with the balance requirements.</p>
2.4	<p>COOLING COILS</p> <p>1) Cooling medium requirement: Chilled water at a temperature of 8 ± 1 Deg C</p> <p>2) The velocity across the cooling coils should not exceed 2.25 m/s. accordingly, cooling coil area should be selected.</p> <p>3) Coils should be of seamless copper tubes with Al fins, 8 rows deep, with 12-13 fins/inch, with copper header, flange connection and SS 304 enclosure.</p> <p>4) Copper tubes should be $25 \pm 5\%$ SWG and hydrostatically tested for 21 kg per sq. cm.</p> <p>5) Cooling coil condensate tray should be of $14 \pm 5\%$ SWG SS 304 material.</p> <p>6) Vertically stacked Cooling coils should have SS 304 drip trays between them and SS pipe drain connection left at the drain tray and finally should be connected to drain point with suitable trap to check ingress of outside air. 7) Fouling factor requirement: 0.0002 hr. m² Deg C/K cal.</p> <p>8) Accessories requirement: Frame, support, inlet and outlet header, vent connection and drain connection with valves, pressure gauges with valves at inlet and outlet and their associated fittings.</p>
2.5	<p>HEATERS</p> <p>The AHUs should have Electrical heaters section to maintain the clean room temperature in the winter season. 1) Strip/Tubular heaters of sufficient capacity should be selected in each AHU to maintain the area temperature. 2) The heaters should be complete with mounting frame, Thermostat, humidistat, astat in redundant arrangement along with all control devices which will be controlled by thyristors.</p>
2.6	<p>HUMIDIFIER</p> <p>1) Type: Pan type, Electrical heating</p> <p>2) Humidification capacity: Sufficient capacity to maintain the required RH levels inside the cleanrooms in dry season.</p> <p>3) For calculating humidification by the above humidifier so as to maintain dew point temperature of the treated fresh air at 12.5 ± 0.5 Deg C, an outside peak winter temperature as per the outdoor conditions to be considered.</p>
2.7	<p>FILTERS</p> <p>There should be 3 stages of filtration in the AHU.</p> <p>Specifications:</p> <ul style="list-style-type: none"> • Filters face velocity should not exceed 2.25 m/sec.

	<ul style="list-style-type: none"> Filter mounting frame should be made out of extruded aluminium material. The frame should be strong enough to withstand the weight of two persons for climbing the frame during the filters replacement. Between filter sections, minimum spacing of 600 mm should be maintained. Filters should have a quick release mechanism and sealing gasket. All the filters should have Al frame (flange type) with a module size of 600 mm x 600 mm (preferably): <ol style="list-style-type: none"> 1st Stage Pre-filters should be of G4 grade as per EN 779, non-woven synthetic material sandwiched between HDPE mesh on both sides with minimum thickness of 150 mm flange type with an initial pressure drop of 5 mm WG or less, suitable for cleaning with dry air or water jet. 2nd stage bag filters should be of F7 grade as per EN779, non-woven synthetic material sandwiched between HDPE mesh on both sides and suitable for minimum thickness of 300mm initial pressure drop of 6-8 mm WG or less, suitable for cleaning with dry air or water jet. 3rd HEPA Filters should be of H14 grade, suitable for AHU capacity. Filter media should be of micro fibre glass, Efficiency required: 99.995% down to 0.3 micron. The filters should have Anodized Al frame with a module size of 600mm x 600mm (preferably). The filter media should be epoxy/PU bonded to the filter casing, Pressure drop < 15 mm of WG. <p>Accessories Requirement: Frame, supports, sealing gasket (Neoprene gasket pasted on the back side of the flange), quick release mechanism.</p>
3	Chiller
3.1	<p>Chillers (Quantity: 2 No.s : 1W+1 S)</p> <p>Air cooled Scroll Chiller: Supply, loading, unloading, lifting, shifting, installation, testing and commissioning of factory assembled, microprocessor controlled air-cooled, single/multiple screw/rotary chiller packages of minimum capacity of 80 TR at 39-41 Deg C ambient conditions prevailing at Chennai. The leaving water temperature from the chiller shall not exceed 7 Deg C when entering water temperature is 12 Deg C. The compressor (s) operating on eco-friendly refrigerants such as R134a/407c/410a complete with controls and accessories, crankcase heaters, automatic modulating capacity control, forced feed lubrication system with oil separator etc. Air-cooled condenser(s) made of copper tubes mechanically expanded into aluminum fins, statically and dynamically balanced low noise condenser fans and motors. Shell and tube DX type/ Flodded type chiller with steel shell and copper tube and complete with drain points. Microprocessor based control center unit in fully enclosed steel cabinet (IP 55 Protection) with power and safety operating controls in separate compartments and complete with monitoring facilities for suction/Discharge pressure, oil pressure, suction line super heat etc. Power supply panel (IP 55 protection) housing all main power connection(s), starters for compressor(s) and condenser(s), factory wiring for compressor(s), condenser(s).</p>
3.2	<p>Chiller Water Pumps</p> <p>1) Quantity – 2 Nos. (1 W+ 1S)</p> <p>2) Pump flow rate: 450 LPM @ 3 Kg/cm²</p>



	<p>3) Pump type: Horizontal centrifugal pumps. 4) Heavy duty for continuous operation 5) MOC: CI 6) Impellor: SS304 7) Motor: Adequately sized TEFC, squirrel cage induction motor having high efficiency rating IE3 Class and suitable for 415V + 10%, 3 Phase, 50 Hz + 5%. 8) Pump shall be horizontal, closed coupled, single stage, centrifugal, end suction with back pull-out design. Hence, the rotating unit can be removed and serviced without disconnecting the suction and discharge pipe. 9) The noise level shall not exceed 75dbA at 1m from the source. 10) Accessories: Pressure gauges at suction and discharge, isolating butterfly valves at suction and discharge, check valve, strainer, integral piping, base frame, foundation bolts, nuts, vibration isolator/rubber pads etc. Pumps should be Horizontal end suction Type.</p>
3.3	Chiller water pipe line
3.3.1	<p>Piping 1) All the pipes shall be SS304 SCH10, PN 10 rated, all pipe lines should be joined with tig welded. 2) Square cut plain ends should be welded for pipes upto and including 100 MM Dia. 3) All pipes 125 MM Dia. or larger should be bevelled by 35 DEG. before welding</p>
3.3.2	<p>Pipe supports/ hangers 1) Pipe supports should be provided and installed for all piping wherever indicated, required or otherwise specified. Wherever necessary, additional hangers and supports shall be provided to prevent vibration or excessive deflection of piping and tubing. 2) All vertical pipe support should be made of 12mm M.S. rods and the horizontal support should be of M.S. angles of 50x50x4 mm thick. 3) Pipe supports should be adjustable for height and prime coated with rust preventive paint & finish coated with black paint using approved grade of paint.</p>
3.3.3	<p>Joining's 1) All pipe lines should be joined with tig welded. 2) All pipes 125 MM Dia. or larger should be bevelled by 35 DEG. before welding</p>
3.3.4	<p>Dual Plate Check valves 1) The body of the check valve should be made from SS304 PN 16 rated, single piece casting in cylindrical shape 2) There should be two plates, which should be hinged in the centre of the circle. 3) Both plates should have springs attached to them for assisting in closing action of the valve. 4) There should be properly/designed metal to metal seal between the plates and the outer body, to ensure non leaking sealing. 5) The valve design should confirm to API 594 or equivalent specifications.</p>
3.3.5	Stainers

	1) Strainers should either be pot type or ‘Y’ type SS304 body PN 16 rated, tested upto pressure applicable for the valves as per design. 2) The strainers should have a perforated bronze sheet screen with 3 mm perforation and with a permanent magnet, to catch iron fillings.
3.3.6	Al Cladding Insulation All the chilled water lines shall be Chilled water line shall be insulated with Puff 50mm thick insulation and cladded with Aluminium sheet.
3.3.7	TESTING 1) In general, tests should be applied to piping before connection of equipment and appliances. In no case should the piping, equipment or appliances be subjected to pressures exceeding their test ratings 2) The tests should be completed and approved before any insulation is applied. Testing of segments of pipe work should be permitted, provided all open ends are first closed, by blank offs or flanges. 3) After tests have been completed the system should be drained and flushed 3 to 4 times and cleaned of all dust and foreign matter. All strainers, valves and fittings should be cleaned of all dirt, fillings and debris. 4) All piping should be tested to hydraulic test pressure of at least one and half times the maximum operating pressure but not less than 10 kg/cm ² for a period of not less than 12 hours. All leaks and defects in the joints revealed during the testing should be rectified to the satisfaction.
3.3.8	Structural work: The Steel structural support for placing chiller and AHU as per the equipment height as to be provided in the designated location.
4	AIR DISTRIBUTION SYSTEM: DUCTS, GRILLS & DIFFUSERS DUCTS AND INSULATION
4.1	Duct Specifications: Complete supply air ducting including the flexible ducting connecting the solid duct work with filters collar and return air ducting is covered under scope of work. <ul style="list-style-type: none"> • Ducts shall be made from GI sheet of lock forming quality having Zinc Coating as per ASTM A-525 G90. • The ducts shall be constructed as per SMACNA standard. • The ducts shall be designed for 100 mm of WC pressure. • The ducts will be used for clean room class 100 environments. To meet this requirement, the GI sheet for manufacturing the ducts shall be totally oil free. • Velocity for Supply Air shall not exceed 1500 fpm and return air shall not exceed 1000 fpm, ducting shall be complete with dampers, vanes, anchor fasteners, supports, access doors, neoprene rubber gaskets etc. • All the ducts shall be supported with the building structure with GI threaded rods of 10mm dia and spring isolators of GI or coated suitable for clean rooms. • Ducting shall include dampers, supports, Isolators etc. • All duct supports, re-enforcement shall be galvanised. • All the dampers shall be Al anodised. • The duct sections shall be joined with Angle iron flange joints. • All the edges with minor leaks should be sealed with silicon sealant.

	<ul style="list-style-type: none"> • Duct inspection window to be provided in the main ducts and plenum boxes. The inspection windows shall be leak proof, easy to open/close. • The ducts fabrication work shall be carried out in dust free environment. <p>Sheet Specifications: All duct work, sheet metal thickness and fabrication unless otherwise directed, shall strictly meet requirements, as described in IS:655-1963 with amendment-I (1971 edition). The thickness of the sheet shall be as follows: -</p>
4.2	<p>Flexible Duct Work</p> <ul style="list-style-type: none"> • Insulated, flexible ductwork shall be installed from AI supply duct work to each HEPA filter ceiling module. • The flexible duct work shall be sealed and secured at each filter module and sheet metal collar utilizing stainless steel flexible duct bands and duct band locks. • The diameter of flexible duct shall be 12” (approx.) matching with the air inlet collar size. • Flexible ducting shall be heavy duty suitable for +2500 Pa of air pressure and 30m/s air velocity. <p>Material of duct: Multiple layers of Al - polyester laminated with spring steel wire helix.</p>
4.3	<p>Volume Control Damper</p> <ul style="list-style-type: none"> • At the junction of each branch duct with main duct and split of main duct, volume dampers must be provided. Dampers shall be two gauges heavier than the gauge of the large duct and shall be rigid in construction. • The volume dampers shall be of an approved type, lever operated and completed with locking devices which will permit the dampers to be adjusted and locked in any positions and clearly indicating the damper position. • The dampers shall be of splitter, butterfly or louver type. The damper blade shall not be less than 1.25 MM (18) Gauge, reinforced with 25 MM angles 3 MM thick along any unsupported side longer than 250 MM. Angles shall not interfere with the operation of dampers, nor cause any turbulence.
4.4	<p>Duct Insulation</p> <p>Supply & Return Air Duct Thermal Insulation with Aluminium foil faced self-adhesive, Closed cell, Nitrile Rubber Insulation with proper sealing of joints filled with silicon sealant. Insulation of duct exposed to atmospheric/ambient conditions using Aluminium faced Closed cell Nitrile rubber, Class ‘O’ fire rating, density not less than 50 Kg/m³ all the joints shall be sealed with 75mm thick Al tape.</p> <p>Supply Air Duct: 19mm thick Return Air Duct: 16mm thick.</p> <p>Al- Cladding: HVAC ducts exposed UV light shall be cladded with Al. Sheets of suitable gauge.</p>
4.5	<p>Standard Grills</p> <ul style="list-style-type: none"> • The supply and return air grills shall be fabricated from extruded aluminum sections. The supply air grills shall have single/double louvers. The front horizontal louvers shall be of extruded section, fixed/adjustable type. The rear vertical louvers where required shall of aluminum extruded sections

	and adjustable type. The return air grill shall have single horizontal extruded section fixed louvers. The grills may or may not be with an outer frame.
	<ul style="list-style-type: none"> The damper blades shall also be of extruded aluminum sections. The grill flange shall be fabricated out of aluminum extruded section. Grills longer than 450 mm shall have intermediate supports for the horizontal louvers.
4.6	<p>Return Air Grills</p> <p>The linear diffusers/grilles shall be fabricated from Aluminium extruded sections. The diffusion blades shall be extruded, flush mounted type with single or double direction air flow. The frame shall be of aluminum extruded section and shall hold the louvers tightly in fixed position. The dampers as described under grilles shall be provided wherever specified.</p>
4.7	<p>Fire Dampers• Automatic fire dampers to be provided wherever required as per the safety standards. The damper shall be multi blade louvre type. The blades should remain in the air stream in open position and shall be constructed with minimum 1.8 mm thick galvanised sheets. The frame shall be of 1.6 mm thickness. Other materials shall include locking device, motorised actuator, control panel to trip AHU motor etc. • The fire dampers shall be capable of operating automatically on receiving signal from a fire alarm panel. All control wiring shall be provided between fire damper and electric panel. • A hinged and gasketed access panel measuring at least 450 mm x 450 mm shall be provided on duct work before each reheat coil and at each control device that may be located inside the duct work.</p>
5	<p>Electrical Panel and cabling</p>
5.1	<p>1) HVAC Electrical Panel : General Design Consideration a) System configuration i. Voltage Supply: 415V± 10% ii. Frequency : 50Hz± 5% iii. No of Phase and grounding: 3 Phase & Solidly ground earth iv. Power Distribution: A.C., 3 Phase 4 wire for 3 Phase system, 1 Phase 3 wire system b) Code & Standards All electrical equipment and accessories to be furnished, installed and commissioned shall be designed, manufactured, tested and installed in accordance with relevant Indian Standard Specifications (ISS), Indian electricity rules and any other applicable regulations. 2) Cabling for electrical supply from wall mounted electrical panel to respective AHUs/Chillers/Pumps/Humidifier shall be armoured copper cables. 3) Copper lugs should be used for cable termination. 4) Bus bar for incoming should be of Copper. 5) Cabling for all the equipment shall be laid through GI ladder or conduit. 6) AHU blower should operate on VFDs 7) Heaters control should be through Thyristors 8) Star-delta starter for chilled water pumps 9) Electrical Panel with bypass arrangement DOL/SD type electrical control panel and provision Microprocessor controller with display for Temperature, RH controlling, monitoring with status (AHU) interlocking with 3 way modulating valve & Strip heater system and SCR for Heater controllers. Provision for : a) AHU (Heaters, Blower, Humidifier) b) Pumps c) Chillers d) Compressor e) Process Cooling Water system 10) AHU panel Interlocks a. Flow Switch-</p>



	1nos b. AHU Door interlock- 1 nos c. Smoke and Fire interlock - 1nos d. Thermal Interlock- 1nos e. Access control Emergency interlock- 1nos.
	<p>2) Sub-Distribution Boards:</p> <p>Switchboards and Switch/Sockets: The scope includes the Supply and installation of different sizes of Switchboards and switch/socket for Lighting, Power Distribution and Trunking.</p> <p>Vendor shall consider suitable rated distribution boards with individual isolators for Cleanroom equipment, lights, fan filter units, power points. Based on the availability of power at site, UPS/Raw Power will be selected for equipment's.</p>
5.2	Electrical Cabling and Accessories (Cables, wire, conduit, earthing, Switchboards, Switches/Sockets etc)
5.2.1	<p>Trunking & Raceway</p> <p>The scope includes Supply of UPVC cable management (Trunking System) and metal raceways, its accessories, installing the same on wall/surface and floor as per the specification and quantities specified in the BOQ. The PVC Trunking shall be fire retardant, low smoke and the contractor shall provide the necessary test certificates in support of this requirement. Cutting of the floor for installing the Raceway shall form part of the installation of the Raceway by the Contractor.</p>
5.2.2	<p>Cables</p> <p>The scope includes the Supply and installation of ISI marked PVC/XLPE insulated, Extruded PVC inner sheath, GI strip armoured overall FRLS PVC outer sheathed, onwall/surface/existing cable tray as required as per the detailed specification and quantity in the BOQ. Control cables shall be copper conductor PVC insulated and power cables shall be XLPE insulated. The necessary hardware for installation of cable like cable tie, clamps, tags etc. will be in the scope of contractor. Make of power/control cable shall be Polycab/ Havells/ KEI/ NICCO/CCI/National/gloster/Ecko. Instrumentation cables shall be conforming to BS 5308, type II, 300/500 V grade with stranded 0.75sq mm copper conductor, PVC insulated, colour coded, twisted to form a pair/pairs, twisted to form a unit, units laid up, myler taped binding, overall screened with aluminium myler tap with tinned copper drain wire, extruded inner sheathed, galvanised steel round wire /strip armoured, overall FRLS PVC sheathed.</p>
5.2.3	<p>Wire</p> <p>The scope includes the Supply and installation of stranded Copper conductor wire, 1100-volt grade, FR PVC insulated single core conforming to IS 694 as per the detailed specification, quantity in the BOQ.</p> <p>Conduit: The scope includes the Supply and installation of ISI make rigid steel, hot dip galvanised conduits of different size, quantity & Specification as per BOQ. The conduit shall be installed on wall/surface/ metal truss/existing cable tray, as required. Flexible conduit shall be made with bright cold rolled annealed and electro-galvanised mild steel. Installation of conduits shall include all necessary hardware, metal strip, welding, clamps etc.</p>
5.2.3	Earthing



	The scope includes the Supply and providing earth pits and earth strips for earthing of Panels, DBs, Process Tools as per established norms/Indian codes and quantities as per the BOQ.																																	
5.2.4	VFD Panels All the blowers must operate through VFD's(AHU Blower, Wet Exhaust Blower)																																	
5.3	PLC Panel With HMI Dedicated HVAC BMS system with HMI panel shall be with the following I/O's.																																	
	M & E SYSTEM EQUIPMENT																																	
		Quantity	Remote Start/Stop Command	Humidifier	Heater	3 way modulating valve	Motorised Damper	Heater	Control Valve	3 way modulating valve	VFD	On/Off Status	Trip Alarm	Motorised Valve Open/Close	Fault Alarm	Hi-Lo Level	Filter Dirty Alarm	Motorised Damper	Supply Air Temperature	Return Air Temperature	Water Supply Temperature	Water Return Temperature	Room Temperature	Room Humidity	3 way modulating valve	Air Flow	Differential Pressure	Voltage	Ampere	PH Reading	Pressure Reading	Flow	Resistivity	
S/N	System																																	
CONTROL PANEL		0																																
1.0	CHILLER	2	2																															
2.0	CHILLER PUMP	2	2								0	2	2																					
3.0	AHU	1	1	1	1	1	1	1	1	1	1	1	1	1				1	1	0	0	0	0	0	1									
4.0	Exhaust Blower	1	1								1	1	1												1									
5.0	Duct temp and RH Sensors room	2																					1	1										
6.0	Air Flow sensor(AHU)	2																				0	0		2									
7.0	Room RH Sensors	1																					0											
8.0	Fire alarm system	1										1																						
9.0	Wet Scrubber(Blower)	1	1								1	1	1												1					0				
10.0	Dry Scrubber(Blower)	0	0								0	0	0												0									
Sub Total :			7	1	1	1	1	1	1	1	3	6	5	1	0	0	0	1	1	0	0	0	0	1	1	0	5	0	0	0	0	2	0	0
I/O Used:		39			11				5				13													10								
Total Spare:		24			6				6				6													6								
Total		63																																
6	Process cooling water Process Cooling water System Independent air-cooled water chiller of suitable capacity to be designed to generate 250 LPM process cooling water at 17-19 Deg C @4-5 bar capacity <ul style="list-style-type: none"> • Buffer tank 1000 Liters • Duty/standby pump set. • Primary chilled water heat exchanger. • SS304 Valves and distribution pipework. 																																	

	<p>Process cooling water pipework shall be SS304, should be thermally insulated where ever appropriate. And 10 tapoff points shall be considered. Tapoff point should have the accessories like pressure regulator, Isolation Valve, Pressure gauge and flow meter.</p> <p>Process Cooling water Distribution: MOC of Distribution Lines: 1" UPVC SCH 80</p>
	<p>No. of Tap-Off Points- 10 nos. (Tap-Off Points: Tap-off Points should have Ball Valve, Gauge, Flow meter, PRV) Pumps: SS304</p> <ol style="list-style-type: none"> 1) Quantity – 2 Nos. (1 W+ 1S) 2) Pump flow rate: 250 LPM @ 6-7 Kg/cm² 3) Pump type: Horizontal centrifugal pumps. VFD driven 4) Heavy duty for continuous operation 5) MOC casing : SS304 6) Impellor: SS304 7) Motor: Adequately sized TEFC, squirrel cage induction motor having high efficiency rating IE3 Class and suitable for 415V + 10%, 3 Phase, 50 Hz + 5%. 8) Pump shall be horizontal, closed coupled, single stage, centrifugal, end suction with back pull-out design. Hence, the rotating unit can be removed and serviced without disconnecting the suction and discharge pipe. 9) The noise level shall not exceed 75dbA at 1m from the source. 10) Accessories: Pressure gauges at suction and discharge, isolating butterfly valves at suction and discharge, check valve, strainer, integral piping, base frame, foundation bolts, nuts, vibration isolator/rubber pads etc. <p>Pumps should be Horizontal end suction Type.</p> <p>Heat Exchanger:</p> <ol style="list-style-type: none"> 1.quantity: 1 nos 2. MOC: SS304 3. Type: Plate,cross flow <p>Controls: Modulating valve for temperature control, thermometer, and pressure sensors for automation.temperature Gauges, pressure gauges</p> <p>Electrical panel: Panel with VFD control and breakers</p>
7	<p>Utility Drain Piping</p> <p>Utility drain pipe shall be PP SCH 80, DN 50. 4 Tap-off points to be provided. All the fume hoods drain will be connected to the drain lines.</p> <p>Main header drain line to be connected to the nearest existing drain line.</p>
8	<p>Gas distribution system</p>
8.1	<p>Panel for Gases:</p>

	<p>Supply, Installation, Testing and commissioning of Cylinder Changeover gas panels for N2, Ar, O2, SF6, CF3, C4F8 to safely regulate the pressure of gas present in cylinder to the pressure required at point of use. The gas supply panel consists of the following components:</p> <ol style="list-style-type: none"> 1) Isolation valve 2) Vent arrangement 3) Pressure Regulator
	<ol style="list-style-type: none"> 4) Safety relief valve 5) inlet Filter - 0.5 um and outlet filters- 0.003um 6) Pressure gauges <p>All these components are to be assembled on an SS plate inside a class 100 cleanroom environment. The panels will be undergoing 5 step testing and validation process for pressure test, Helium leak test, Trace moisture test, Trace oxygen & particle count.</p> <p>Panels for UHP Gasses:</p> <p>N2- 4-cylinder auto Cylinder changeover panel Ar- 2 auto Cylinder changeover panel O2- Cylinder changeover panel SF6- Cylinder changeover panel CF3- Cylinder changeover panel C4F8- Cylinder changeover panel</p>
8.2	<p>Gas Tubing</p> <p>SS316L EP Tube</p> <p>Supply, installation, testing and validation of SS316L, 10 Ra electropolished Tubes of 1/4", all the joints shall be orbitally welded. Upon completion of installation, the tubes shall undergo 5 step testing and validation. The steps are :</p> <ul style="list-style-type: none"> - Pressure hold test (0 psi drop over 24 hours) - Helium leak check (10^{-9} mbar l/sec) - Trace oxygen (<10ppm) - Trace moisture (<10ppm) - Trace Particle (<0.1 micron)
8.3	<p>Gas Line Tap-off Points</p> <p>All the gas line tap-off points must have UHP Valve, Regulator and Gauge</p>
8.4	<p>Gas grid- Refer table titled "Summary of Cleanroom Equipment with Utility Requirements"</p>
9	<p>Wet chemical exhaust</p>

	<p>Exhaust Requirements • The blower (1no) should be placed at the terrace of the building (building height 20 feet). Exhaust Blower capacity: 400 CMH @ 125 mm total static or more (3Benches- Each Bench Blower Capacity approximately 900cfm). Exhaust Blower MOC: FRP molded blower. Blower outlet weather cawl and motor Guard should be provided • PP Damper at the exhaust line main near the blower 1 nos. • The blower should be noise and vibration free. • Blower should be installed properly and electrical connection to be provided with suitable starter. • Blower Output should be properly designed for exhaust. • Blower outlet should be connected with lengthy ducting with suitable bends and supports (Approx – 10 feet vertical and bend) • Ducting PP+FRP 3+2 mm thick with VCD- Approximately 35RMT with Dia. 300mm for all the 2 wet station branches with damper for each wet bench and Dia. 350mm(35RMT) for main piping from bench to blower PVC ducting for supply air with damper should be provided. • Electrical Cabling with suitable DOL starter should be provided.</p>
10	UPS
10.1	<p>Capacity 250 KVA/250 KW With Galvanic Isolation Transformer at output</p>
10.2	<p>Input Rectifier- IGBT - based PFC Input Voltage Range (Ph-Ph)- 400 V AC, -/+15% Input Frequency Range- 50 / 60 Hz + 10 % Input Current Harmonics (THDi)- <3% at 100% load, <3% at 75% load, <5% at 50% load Input Power Factor-> 0.99 Input Phase sequence auto-correction- Required Rectifier sequential start-up (hold-off-) - Settable from 1 to 300 Seconds Rectifier soft-start (Power walk-in)- Settable from 5 to 30 Seconds</p>
10.3	<p>Batteries Temperature Compensated Battery Charging Battery Backup - 15 Min backup @ full load (250 KW) considered. Calculation shall be as per IEEE 485 Standard Battery Ah and quantity- Vendors may provide quantity and capacity of batteries based on the DC voltage of the UPS and according to battery wattage Chart provided by the manufacturer and consider design margin of 10% and aging factor 25%, Pf 1 Battery Make- AGM VRLA, Make Panasonic/Quanta/Exide Confirming to JISC :8702 (Pt, I,II,III) Battery type- FR battery Battery minimum VAH - 230000 VAH DC Ripple- <1% Common Battery Bank option- Required</p>
10.4	<p>OUTPUT Inverter technology - 3-Level IGBT (High Frequency PWM)</p>

	<p>Nominal Output Voltage (selectable) - 380-400-415 Vac)</p> <p>Output Voltage Stability:- Static (Balanced Load) (%): $\pm 1\%$- Static (Unbalanced Load) (%): $\pm 2\%$- Dynamic (Step Load 20%÷ 100% ÷20%) (%):$\pm 5\%$- Output Volt. Recovery Time(after step load) (ms) : < 20 msOutput Frequency (selectable) (Hz) : 50 / 60Output Frequency Stability - Free Running Quartz Oscillator (Hz): ± 0.001 Hz- Inverter Sync. with Mains (Hz) : $\pm 2\%$- Slew rate (Hz/s) : <1Output Power Factor of UPS: UnityOverload capacity : 125% for 5 minutes; 150% for 30 Seconds; >150% for 100 msOutput Harmonic Distortion (%) - Linear Load : < 1% - Non-Linear Load : < 5 %Crest Factor: 3:1Output Waveform: Sine wave</p>
11	DG
11.1	Genset Capacity: 365 KVA/292 KW
11.2	<p>DG set</p> <p>Diesel Generator set must be with the following specifications :-</p> <ul style="list-style-type: none"> • Prime rating at rated rpm (as per ISO8528) must be 365KVA/292KW. • Vendor must specify the Genset Model. • Frequency, Power factor, voltage (with 3-phase supply) must be respectively 50Hz, 0.8 lagging, 415V. • Governing Class (as per ISO 8528 Part-V) must be G3. • Noise level must be < 75 d BA • Fuel Tank capacity must be 900 Ltrs \pm 10 Ltrs. <p>Electrical Battery starting voltage must be 24V.</p>
11.3	<p>Engine</p> <p>Genset Engine must be supplied with following specification :-</p> <ul style="list-style-type: none"> • Rated output (prime continuous rating as per ISO 8528-1) must be 292 KW \pm 5 KW • Rated RPM must be 1500 with bore x stroke length • Lube Oil change period must be for 500 Hrs. • Lube oil sump capacity should be 53 Ltrs \pm 2 Ltrs. • The Engine must be radiator cooled and cooling capacity must be 145 \pm 5 Ltrs. <p>Genset Engine must be supplied with following:- Electrical starter motor 12V DC Battery charging alternator , Bosch fuel system with mechanical governor, A1 Class , Spin-on lube oil filter and Spin-on dual fuel filter with water separator, Turbocharger, Charge air cooler, Silencer (Hospital grade),Dry type air cleaner, Shutoff coil, Flywheel and flywheel housing, first fill of lube oil and coolant.</p>
11.4	<p>Alternator</p> <p>Genset Alternator must be with following specifications :-</p>

	<ul style="list-style-type: none"> • Alternator is suitable for operation at 1500 RPM, 415 Volts, 0.8 pf (lag) suitable for 50 Hz, 3 phase, 4 wire systems, conforming to IS/IEC 60034-1 • Class-H insulation with IP:23 Protection. • The Alternator must be brushless type, screen protected, revolving field, self-excited, self-regulated through an AVR. • Alternator Efficiency(at 100% load)0.8pf must be 94±0.5 • Alternator Efficiency(at 75% load)0.8pf must be 94.5 ±-0.5 • Permissible voltage dip at full load 0.8pf lag must be ≤19% • Time permitted to build up rated voltage at rated rpm must be < 1 Sec provided engine reached rated speed. • Short circuit ration must be 0.485 ± 0.005 • Short circuit withstand time must be 3 times rated current for '10 sec'
	Permissible overload of 10% for one hour in 12 hours of operation
11.5	<p>Control Panel</p> <ul style="list-style-type: none"> • The control panel must be manufactured with 14/16 gauge CRCA sheet and is powder coated for weather-proof and long lasting finish. <p>The control panel must consists of the following parts:- Micro processor based Controller, Aluminium bus bars with suitable capacity within/outgoing terminals, Indicating lamps for 'Load On' and 'Set Running', Instrument fuses duly wired and ferruled, MCCB of suitable rating with overload and short circuit protections.</p>
11.6	<p>Genset Controller</p> <p>Microprocessor-based generator set monitoring and control system must have following specification :-</p> <ul style="list-style-type: none"> • The control must provide a simple operator interface to the generator set, manual and remote start/ stop control, shutdown fault indication, and an LCD hour counter. • All functions must be integrated into a single control system providing enhanced reliability and performance compared to conventional generator set control systems. • This control must be designed and tested to meet harsh environment in which Gensets are typically applied. Features, Functions, protections 16 character x 2 line alphanumeric LCD display with LED Backlight. • Controller should display the following parameters for monitoring: - a)Phase Voltages & Currents, Frequency, Reverse power, Genset kVA, kW, kWh, kVA, Power Factor, Canopy Temperature. <ul style="list-style-type: none"> b) Lube oil Pressure, Engine Temperature, RPM, Run Hours, Number of starts, Fuel Level, Auto / Manual Stop. c) Battery Charger condition d) AMF Feature e) Modbus communication, Synchronization, remote monitoring.

	<ul style="list-style-type: none"> The following Diagnostic features must be displayed : - <ul style="list-style-type: none"> a) Battery charging failure, Over/Under speed, Over current, over / Under Voltage, Over kW, Phase Seq., Phase missing, Mains Under voltage, Earth Fault. trip, Fuel usage Alarm. b) Low lube oil Pressure, High Engine Temp, Low/High battery voltage, Low Fuel level ,Over Crank protection , routine maintenance indicator, Genset test facility, Mains frequency. Control includes provision for Service adjustment and calibration of DG control functions, Voltage, frequency selection, Configurable input and output set up, Meter calibration, Engine controls, Power Start operates on 12 VDC batteries. Auto start mode accepts a ground signal from remote devices to automatically start the DG set. The remote start must also wake up the control system from sleep mode.
11.7	<p>Engine Starting</p> <ul style="list-style-type: none"> The control system supports automatic engine starting, Primary and back up start disconnects are achieved by battery charging alternator feedback or main alternator output frequency. Controller provide configurable time delay of 0-300 secs to start after remote start signal and time delay of 0-600secs prior to shut down after stop signal. Sleep mode increase battery life. Configurable current settings from low to minimize current draw when genset is not working. Engine Protective functions must include :-Configurable alarm output, Emergency stop: Annunciated whenever an emergency stop signal is received by the control. Low lube oil pressure warning and Shutdown, High engine water temp warning / Shutdown, Low coolant temp warning, Sensor failure indication, Low and high battery voltage warning, Weak battery warning, Fail to start shut down, Cracking lockout: Control will not allow the starter to engage or to crank the running engine. Cyclic cranking: Configurable for the number of starting cycle, (1 to 7) and duration of crank and rest periods. <p>Alternator Protective functions includes, - High and Low AC voltage shut down, Under and Over frequency shutdown / warning, Loss of sensing voltage input shut down.</p>
11.8	<p>Acoustic enclosure/Canopy</p> <ul style="list-style-type: none"> The acoustic enclosure shall be made of 1.6 mm thick CRCA sheets in suitable approved shade and a structural/ sheet metal base frame painted in black. The walls of the enclosure are insulated with fire retardant foam so as to comply with the 75dBA at 1 mtr sound levels specified by Ministry of Environment & Forest. The enclosure has the following features: Specially designed to meet stringent MOEF/ CPCB norms of 75dBA @ 1mtr at 75% load under free field conditions, Two point lifting for easy handling at customer site, Designed to have optimum serviceability,.



	<ul style="list-style-type: none"> Air inlet louvers specially designed to operate at rated load made on special purpose CNC machines for consistency in quality and workmanship, Powder coated for long lasting service life and superior finish, With UV resistant powder coating, can withstand extreme environment. <p>Use of special hardware for longer life, Insulation material meets exacting IS 8183 specifications for better sound attenuation, Flush styling - no projections, Fluid drains for lube oil and fuel, Fuel filling point inside the enclosure.</p>
11.9	ATS panel for the auto changeover for DG
12	<p>Door interlocks and access control for entry to clean room</p> <p>Air Shower Door should have provision for installing biometric sensors. Air-shower Door should be able to open only after successful verification / validation of proximity type access control system validates the authorization for the person / proximity card. The access control system shall be controlled through software and it should be possible for logging the data of personnel movement in and out of the labs and to be stored in the PC as a record. Storage provision of at least 6 month's data is the minimum requirement and this should be able to copy and kept in another storage medium.</p>
13	<p>CCTV Camera</p> <p>HDMI type CCTV cameras (Megapixel level) to be provided by the vendor. The vendor has to install electrical power cable and suitable sockets for all the CCTV cameras; supply and installation of compatible signal cable to the CCTV control and monitoring system at service area (BMS control room). Electrical power supply for the CCTV cameras shall be brought on the UPS power for handling situations during power interruptions. The location of this CCTV cameras shall be as placed in the following areas:</p> <ol style="list-style-type: none"> Class 100 – 2 No.s Class 1000 – 6 No.s Clean room Entrance – 2 No.s Gowning area, Visitor area, UPS room and utility room – 1 No each AHU area – 4 No.s <p>All the camera outputs are to be stored in an HD-compatible DVR with a minimum HDD capacity of 1TB and it should be able to display through the available display unit.</p>
14	<p>LAN and Telephone & Intercom</p> <p>Class 100 and Class 1000 will have 5 LAN points each. Class 100 and Class 1000 will have 1 Telephone point each.</p>
15	<p>Testing and Validation of Clean Room</p> <ul style="list-style-type: none"> Certification of Clean Rooms shall be done through an experienced Third party Agency Tests shall be performed in 'As- Built' condition in accordance with the testing Procedure specified in ISO 14644.



	<ul style="list-style-type: none"> · The “independent” testing firm shall have experience of having conducted Clean Room testing for certification of minimum 2 (two) Class 100 Clean Rooms in the last 5 years. · The Clean Room Certification agency shall submit performance testing report for approval. · In the event of non-conformance to the defined Clean Room parameters, the Contractor shall take corrective action at his cost. The Clean Room certification shall be re-done at Contractor’s cost, to establish conformance to specifications. · Performance Testing and Certification of Clean Rooms as per ISO 14644 through an ‘Independent’ Certification Agency, under “As Built”, "At Rest" and “ At Operation” conditions. <p>Validation: of the Cleanroom as per ISO14644 and following documents to be submitted along with the validation reports.</p> <ul style="list-style-type: none"> o Temperature o Relative Humidity o Particle count o Filter Integrity test
	<ul style="list-style-type: none"> o Air velocity test o Differential room pressure test (pressure Zoning) o Recovery test o Air balancing o Pressure balancing
16	<p>Installation and Training</p> <p>Clean rooms mechanical assembly shall be done by the Supplier. Electrical system installation shall be done by qualified and authorized electrician employed or subcontracted by the Supplier.</p> <p>Supplier must arrange for materials unloading and staging. The Supplier shall provide full training on the clean rooms' operations, equipment preventive maintenance and repair. Final documentation shall include the training manuals. Operation and maintenance manuals should be provided by the supplier</p>

17	<p>Documentation</p> <p>In order to have Complete system documentation, the following documents have to be provided:</p> <ul style="list-style-type: none"> • System GA, Layout and PID drawings • wiring diagrams • lists of parameters to be monitored • Installation, Commissioning reports • SOP • Recommended Spares List <p>For hand-over, all documents must be up-to-date and provided with the date. Final documentation should contain both hard-copies & soft-copies</p>																																																																											
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24	Security camera	Bosch/Equivision/CP Plus
25	Fire Panels	Notifier/Bosch
26	Cables and wires	Polycab
27	Switches/Sockets/MCB/MCCB	ABB /Legrand/Schneider
28	BMS System Controller/Router:	Siemens /Regin/Sauter
29	Polypropylene Fume Hood	Nano Clean Technologies/Kewanee/ESCO
30	Polypropylene Chemical Storage Cabinet	Nano Clean Technologies/Kewanee/ESCO
31	Air Shower	Esco/ Klenzoids /Terra Universal/Sam/Fabtech
32	Static Pass Box	Klenzoids Thermadyne/Fabtech**
33	Sterile Garment Storage	Esco/Klenzoids/Fabtech**
34	Compressor	KAESER/Ingersoll Rand
35	Process Cooling Chiller	Wernerfinly/Trane/Carrier
36	DI Water Plant	Millipore /Siemens
37	Smoke & Fire Detection	Bosh/Notifier
38	Door Interlock	Honeywell/Bosch
39	Wet Scrubber	Alpha Projects/Driz Gas/ Nano Clean Technologies
40	Dry Scrubber	Alpha Projects/Driz Gas/ Nano Clean Technologies
41	VFD	Danfoss/ABB
42	Cleanroom Furniture	Terrauniversal/ Nano Clean Technologies

Thanking you,

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