



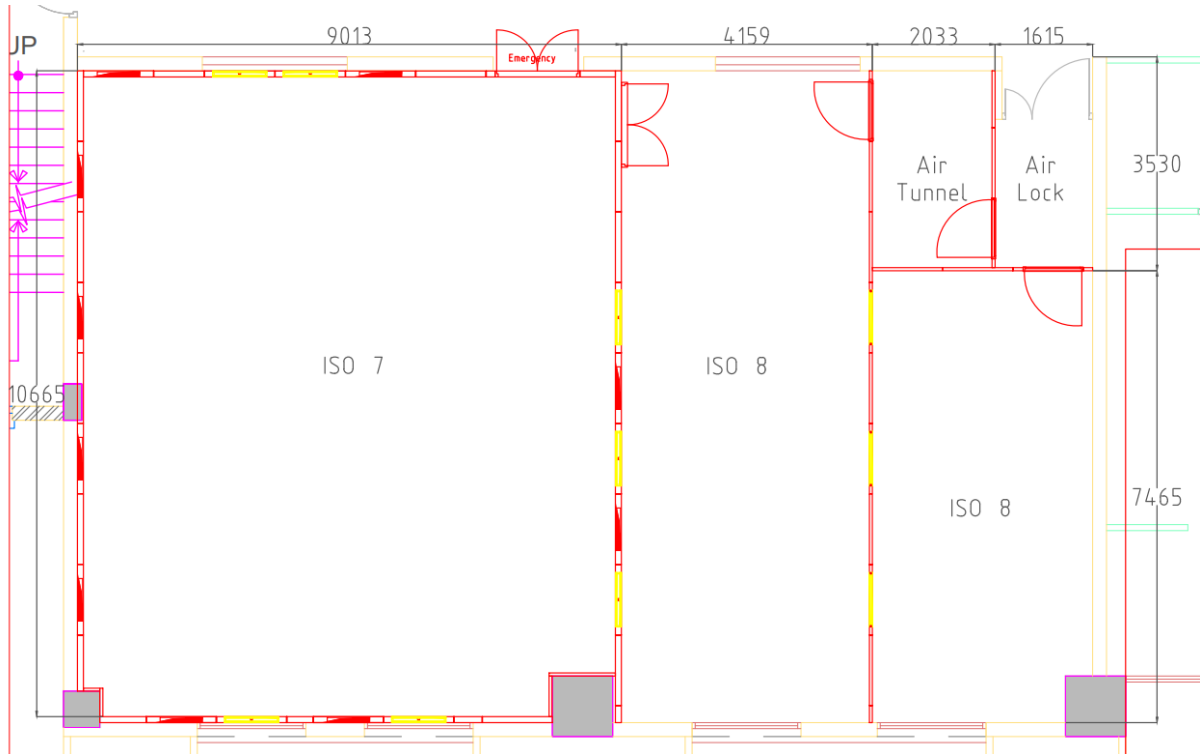
### **Request for quote “Cleanroom for Packaging Lab”**

- The GEECI (Gallium Nitride Ecosystem Enabling Centre and Incubator) at SID-Indian Institute of Science is seeking bids from qualified bidders for a Cleanroom for packaging lab. The specifications are listed in Table below.
- Companies need to submit two bids, a technical bid and a commercial bid, in two separate sealed envelopes. The bids should be submitted no later than 15 days from the date of posting of this tender, as listed on the website date/time stamp, and by 5 pm on the 15th day or next weekday in case the 15th day falls on a weekend or a national holiday.
- Both technical and commercial bids should be addressed to “The Chief Executive, SID, IISc, Bangalore 560012.” GST # 29AAATS5333E1ZJ”
- The envelopes should be addressed to “Prof. Srinivasan Raghavan, CeNSE, IISc, Bangalore, 560012” and submitted to the office at CeNSE, IISc in Room No. GF 15 between 9 am and 5 pm.
- All questions regarding this tender should be addressed to Mr. Raghupathy at the email address [raghupathyn@iisc.ac.in](mailto:raghupathyn@iisc.ac.in)
- Post such submission all vendors should send an email to [sraghavan@iisc.ac.in](mailto:sraghavan@iisc.ac.in) with the subject line: “GEECI\_Bidder’s name Tool Name” to intimate him of the submission within one day.
- Deviations from the technical specifications requested are allowed. Such deviations must be highlighted and justified. Their acceptance or rejection will be left to the discretion of the technical committee.
- The Cleanroom sought will be at the Centre for Nano Science and Engineering (CeNSE), Indian Institute of Science (IISc). IISc is India’s No. 1 institution on higher learning and the Centre for Nano Science and Engineering is home to one of the best academic fabs in the world.
- The technical response, corresponding to the offered, should be in the form of a compliance table with at least 5 columns. Serial number in column 1. Each of the numbered technical items below should be addressed in a separate row of the table in column 2. Compliance to this requirement, in Yes/No, deviation from it and justification should be provided in the neighbouring columns 3-5. Post the opening of a hard copy of the technical bid the committee will request for a soft copy of the files for further processing. Companies should NOT mail soft copies of the files unless specifically requested for.
- Detailed technical specifications of the equipment being offered should be included.
- 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.
- If multiple systems can fulfil the requirements, vendors can submit multiple bids.
- Vendors are encouraged to highlight the advantages of their system from the competitors
- The commercial bid should be broken up to the maximum extent possible into separate items with a cost against each to enable better comparison of price for various configurations across the bidders. As an option, please provide itemized cost for any suggested accessories/add-ons that may enhance the usability, capability, accuracy, or reliability. Vendors are encouraged to quote for as many add-ons as their portfolio permits only 1.

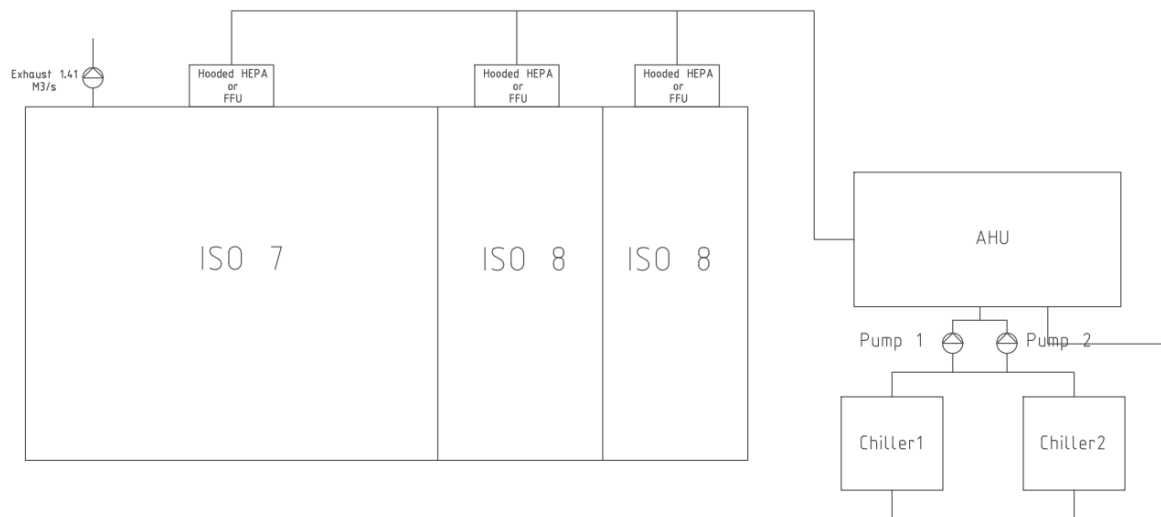
## Cleanroom Specifications

Sl.No.	Description	Specification
1	Clean Room Classification	ISO7 & ISO 8
2	Area	198 m <sup>2</sup>
3	Temperature in °C	22±2
4	RH in %	50±2
5	Positive Differential Pressure	15 Pa
6	Application	Semiconductor Application
7	Heat Load	21 Kw
8	Room Occupancy	20
9	Lighting Level	500 Lux
10	Sound levels	Less than 55 db
11	Process Exhaust	1.4 m <sup>3</sup> /s
12	Utilities Required	Compressed Air, Process Cooling Water, N <sub>2</sub> , Ar, O <sub>2</sub>
13	Process Exhaust	1.4 m <sup>3</sup> /s
14	Validation	Temperature Relative Humidity Particle count Filter Integrity test Air velocity test Differential room pressure test (pressure Zoning) Recovery test Air balancing. Pressure balancing
15	Warranty	1 Year

## Layout Drawing



## HVAC Schematic



1. The successful bidder should setup the clean room facility as per the clean room plan drawing is given and HVAC Schematic give in the above drawing
2. The bidders are advised to make a site visit prior to bidding in order to ascertain the exact quantum of work to be undertaken and be able to quote their best for the specification and quantity as mentioned in BOQ.
3. The bidder should submit test certificates for major OEM components as required by user during the supply of materials.
4. Installation & Commissioning: Bidder should be responsible for installation / commissioning and for after sales service during the warranty period and thereafter as mentioned in the order.
5. Any other item/work not specified above but required for completion of intended work shall be deemed to be part of the scope of work to be executed by the successful bidder.
6. Bidder should bring tools, consumables and manpower required for implementation of the work.
7. All the industrial safety practices must be followed during implementation of the project
8. Bidder should warranty entire facility including clean room and other installed service for a period of 1 years for all materials and machines. During warranty period bidder should monitor the complete facility and installed services and carry out necessary corrections, repair or replacements, if required, for smooth operation of the clean room facility & services as per laid down specifications.
9. For HVAC work with HEPA filtration validation of particle count test, temperature & relative humidity, air velocity, AHU capacity & Air changes has to be confirmed after commissioning of work by the successful bidder.
10. Documentation for DQ-IQ-OQ has to be submitted with a set of as built drawing after completion of the work including OEM test reports of critical components.

S.NO	SPECIFICATION
<b>1.</b>	<b><u>AIR HANDLING UNIT (AHU) (Quantity- 1No)</u></b>
<b>1.1</b>	<p><b>AHU CASING</b></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/m<sup>3</sup>.</p> <p>3) The framework for each section shall be joined together with soft rubber gasket in between to make joints</p>



	<p>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 (A).</p>
<b>1.2</b>	<p><b>CIRCULATION FAN</b></p> <ol style="list-style-type: none"> <li>1) Fan Type: Direct driven, Plug type high efficiency centrifugal fan</li> <li>2) Desired noise level should be reduced to 70+5 dB (A) or less by suitable sound attenuators on supply and return air path.</li> <li>3) Required Total static pressure: 150 ± 2 mm WG.</li> <li>4) Fans should have backward curved blades to improve efficiency.</li> <li>5) Fan blades should be made of Aluminium alloy for stability.</li> <li>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.</li> <li>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.</li> <li>8) The motor should be of high Efficiency IE3 class as per IS 12615 – 2011- Non FLP.</li> <li>9) Motor should be compatible for VFD operation.</li> <li>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.</li> <li>11) Fan should be factory statically and dynamically balanced as required to achieve field balance levels.</li> <li>12) Epoxy based coating shall be provided on all the surfaces of ferrous fan housing.</li> <li>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.</li> <li>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.</li> </ol>
<b>1.3</b>	<p><b>COOLING COILS</b></p> <ol style="list-style-type: none"> <li>1) Cooling medium requirement: Chilled water at a temperature of 8 ± 1 °C</li> <li>2) The velocity across the cooling coils should not exceed 2.25 m/s. accordingly, cooling coil area should be selected.</li> <li>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.</li> <li>4) Copper tubes should be 25±5% SWG and hydrostatically tested for 21 kg per sq. cm.</li> <li>5) Cooling coil condensate tray should be of 14±5% SWG SS 304 material.</li> <li>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.</li> <li>7) Fouling factor requirement: 0.0002 hr. m<sup>2</sup> O C/K cal</li> <li>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.</li> </ol>
<b>1.4</b>	<p><b>HEATERS</b></p>



	<p>The AHUs should have Electrical heaters section to maintain the clean room temperature in the winter season.</p> <ol style="list-style-type: none"><li>1) Strip/Tubular heaters of sufficient capacity should be selected in each AHU to maintain the area temperature.</li><li>2) The heaters should be complete with mounting frame, Thermostat, humidistat, airstat in redundant arrangement along with all control devices which will be controlled by thyristors</li></ol>
<b>1.5</b>	<b>HUMIDIFIER</b> <ol style="list-style-type: none"><li>1) Type: Pan type, Electrical heating</li><li>2) Humidification capacity: Sufficient capacity to maintain the required RH levels inside the cleanrooms in the dry season.</li><li>3) For calculating humidification by the above humidifier so as to maintain dew point temperature of the treated fresh air at <math>12.5 \pm 0.5</math> Deg C, an outside peak winter temperature as per the outdoor condition to be considered.</li></ol>
<b>1.6</b>	<b>FILTERS</b> <p>There should be 3 stages of filtration in the AHU. Specifications:</p> <ul style="list-style-type: none"><li>• Filters face velocity should not exceed 2.25 m/sec.</li><li>• 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.</li><li>• Between Filter sections, minimum spacing of 600 mm should be maintained.</li><li>• Filters should have a quick release mechanism and sealing gasket.</li><li>• All the filters should have Al frame (flange type) with a module size of 600mm x 600mm (preferably).</li></ul> <ol style="list-style-type: none"><li>1) 1 st 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 150mm flange type with an initial pressure drop of 5 mm WG or less, suitable for cleaning with dry air or water jet.</li><li>2) 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.</li><li>3) 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 &lt; 15 mm of WG.</li></ol> <p>Accessories Requirement: Frame, supports, sealing gasket (Neoprene gasket pasted on the back side of the flange), quick release mechanism.</p>
<b>2.0</b>	<b>Chillers</b> <ul style="list-style-type: none"><li>• Energy efficient Air-cooled, high efficiency Scroll chillers of specified Tonnage as per design requirement and BOQ, using environment friendly refrigerant (Non CFC), suitable for outdoor installation with weatherproof enclosure.</li><li>• Microprocessor-control panel along with chiller load management option inbuilt, to be hooked up to BMS for parameters monitoring and control.</li><li>• The total load to be catered by preferably multiple scroll compressor as per seasonal load demand.</li><li>• OEM to stand guarantee to supply chiller spares for a minimum period of 10 years after warranty.</li><li>• Chiller OEM (Original Equipment Manufacturer) shall have local trained personnel in India, in case of imported chillers. The chillers should be AHRI certified.</li></ul>

	<b>No. Of circuits: Min. 2</b>
<b>2.1</b>	<p><b>CHILLED WATER PIPING</b></p> <ol style="list-style-type: none"> <li>1) The line shall be Seamless SS 304 SCH 10 pipes.</li> <li>2) Booster pumps with one working and one stand-by arrangement (for each AHU) shall be provided in the chilled water line.</li> <li>3) The line shall be complete with all the fittings like valves, flanges, bends etc.</li> <li>4) The flanges shall be SS heavy duty (rating PN 16).</li> <li>5) The gaskets shall be good quality neoprene of appropriate thickness.</li> <li>6) Pressure gauges having suitable range and ½” connection size shall be of 4” dial type, with Bourdon movement. All internal parts shall be of SS 316. The over range protection shall be 125% of maximum range.</li> <li>7) The temperature gauges of suitable range shall be 4 inches dial type. The sensor, capillary and thermo-well shall be SS316.</li> <li>8) The bolts and nuts shall be of not less than 8.8 Grade. Spring washers of required thickness shall be used with pumps, motors and other moving machinery while plain washers of required thickness shall be used at all other places.</li> <li>9) Insulation on chilled water piping, valves, fittings, pumps etc. shall be done using PUF of 50 mm thickness and having density not less than 40 Kg/cubic meter. The pipes and the other surfaces where insulation is to be applied shall be cleaned so that surface is free from rust, dust and other foreign materials.</li> <li>10) Two coats of 85/25 bitumen/CPRX shall be applied on the entire pipe surface and the inside surface of the pipe section/slabs (as required) of insulating material so that the insulating mass sticks with the pipe properly. Thereafter white transparent polyethylene sheet of thickness not less than 500 gauge shall be wrapped all along sealing the insulation mass, overlapping the joints by not less than 50 mm and sealing them properly using bitumen/CPRX/ good quality adhesive tape. Over the polyethylene sheet, 0.5 mm thick aluminium sheet shall be used as cladding to cover the insulation in a quality manner.</li> <li>11) Water flow direction to be marked on the respective pipes. Insulation shall be applied only after the piping system has been satisfactorily tested for leaks as per specifications.</li> </ol>
<b>2.2</b>	<p><b>BUTTERFLY VALVE</b></p> <ol style="list-style-type: none"> <li>1) The butterfly valve should be SS304 body with EPDM liner and SS316 disc preferably in two piece Construction.</li> <li>2) The disc should consist of disc pivot and driving stem shall be in one piece centrally located.</li> <li>3) The valve seat should be synthetic material suitable for water duty. It shall line the whole body.</li> <li>4) The disc should move in slide bearings on both ends with ‘o’ ring to prevent leakage.</li> <li>5) The handle should have arrangement for locking in any set position.</li> <li>6) All valves 200mm Dia. and above should be gear operated.</li> <li>7) The valve should be suitable for 16 Kg/cm<sup>2</sup> working pressure.</li> </ol>
<b>2.3</b>	<p><b>BALL VALVE</b></p> <ol style="list-style-type: none"> <li>1) All Valves should be of SS304 single piece type PN 16 rated.</li> <li>2) Ball type Valves with (FPT) female threads conforming to class 2 of IS 778 and mating flanges fitting.</li> <li>3) All Ball valves should be ISI Marked.</li> </ol>
<b>2.4</b>	<p><b>3 WAY MODULATING VALVE</b></p> <p>3-Way proportioning control valve PN16 suitable for required pipe sizes (with all necessary concentric reducers and flange connections to be included). MOC: CI.</p>



2.5	<p><b>DUAL PLATE CHECK VALVE</b></p> <ol style="list-style-type: none"> <li>1) The body of the check valve should be made from SS304 PN 16 rated, single piece casting in cylindrical shape</li> <li>2) There should be two plates, which should be hinged in the centre of the circle.</li> <li>3) Both plates should have springs attached to them for assisting in closing action of the valve.</li> <li>4) There should be properly/designed metal to metal seal between the plates and the outer body, to ensure non leaking sealing.</li> <li>5) The valve design should confirm to API 594 or equivalent specifications.</li> </ol>
2.6	<p><b>STAINERS</b></p> <ol style="list-style-type: none"> <li>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.</li> <li>2) The strainers should have a perforated bronze sheet screen with 3 mm perforation and with a permanent magnet, to catch iron fillings.</li> </ol>
2.7	<p><b>JOINING</b></p> <ol style="list-style-type: none"> <li>1) All pipe lines should be joined with tig welded.</li> <li>2) Square cut plain ends should be welded for pipes upto and including 100 MM Dia.</li> <li>3) All pipes 125 MM Dia. or larger should be bevelled by 35 DEG. before welding.</li> </ol>
2.8	<p><b>PIPE SUPPORTS/HANGERS</b></p> <ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>3) Pipe supports should be adjustable for height and prime coated with rust preventive paint &amp; finish coated with black paint using approved grade of paint.</li> </ol>
2.9	<p><b>TESTING</b></p> <ol style="list-style-type: none"> <li>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</li> <li>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.</li> <li>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.</li> <li>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<sup>2</sup> 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.</li> </ol>
2.91	<p><b>1.1 CHILLED WATER PUMPS</b></p> <ol style="list-style-type: none"> <li>1) Quantity – 2 Nos.(1 W+ 1S)</li> <li>2) Pump flow rate Suitable</li> <li>3) Pump type: Horizontal centrifugal pumps.</li> </ol>



	<ol style="list-style-type: none"> <li>4) Heavy duty for continuous operation</li> <li>5) MOC: SS304</li> <li>6) Impellor: SS304</li> <li>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%.</li> <li>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.</li> <li>9) The noise level shall not exceed 75dbA at 1m from the source.</li> <li>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.</li> </ol>
<p><b>2.92</b></p>	<p><b>1.2 INSTRUMENTATION &amp; CONTROL</b></p> <ol style="list-style-type: none"> <li>1) Three-way flow control valve, complete with all the accessories and with a manual bypass line with an isolation valve.</li> <li>2) Temperature and RH sensor to measure the temperature and humidity of the respective areas. Accuracy levels: Temperature: + 0.2 Deg C or better, RH: + 1% or better.</li> <li>3) Cooling coil water inlet and outlet temperature sensor cum transmitter.</li> <li>4) Pressure gauges with isolation ball valves at inlet and outlet of the coils. Temperature gauges with thermowells.</li> <li>5) Pressure gauges with isolation ball valves at inlet and outlet of all the pumps</li> <li>6) Differential pressure sensor across pre filters and fine filters.</li> <li>7) VFDs for AHU fans.</li> <li>8) HMI control panel for monitoring temp and RH of all rooms. AHU supply air volume shall be varied based on the room exhaust flow rates.</li> </ol>
<p><b>3</b></p>	<p><b>DUCTING</b></p> <p>Ducts shall comprise of factory fabricated uninsulated GI sheet metal ducting with zinc deposition of 120 gm/m<sup>2</sup> as per SMACNA with all required accessories and fittings with RTV sealant, gaskets complete with GI supports, MS flanges duly painted, fully threaded GI rods, GI nuts and bolts, vanes, splitters etc. as per SMACNA standards for pressure class rectangular ducts. Air flow direction to be marked on the respective ducts. The gauge of ducting material shall depend upon the sizes as per Standards mentioned below:</p> <ol style="list-style-type: none"> <li>a) 18 G (1.27 mm thick) suitable for &gt; 50 inch diagonal ducts</li> <li>b) 20 G (0.95 mm thick ) for &gt; 40 inch ducts</li> <li>c) 22 G (0.8 mm thick) for &gt; 30 inch ducts</li> <li>d) 24 G (0.64 mm thick) for &gt; 20 inch ducts</li> </ol> <p>Construction Features (applicable only for factory fabricated ducts):</p> <ol style="list-style-type: none"> <li>1) All ducts transformation pieces and fittings shall be made on CNC profile cutters and all ducts shall be factory made using lock forming machine. The sheet thickness, brazing, flanges and length of the ducts shall be as per ISO standards.</li> <li>2) Non-toxic, AC-application grade P.E or PVC gasketing shall be provided between all mating flanged joints gasket sizes shall conform to flange manufacturing specifications.</li> <li>3) To avoid leakage silicone sealant shall be used and leakage from duct joints shall be minimum (3 to 5%).</li> </ol>

	<ol style="list-style-type: none"> <li>4) The specific class of transverse connectors for a given duct dimensions shall be as per SMACNA 2005 standard for duct pressure class of 4" wg (1000 Pa).</li> <li>5) Rectangular duct shall be supported from roof / purlins / truss / ceiling using hanger rods. Ducts shall rest on supporting MS slotted angle or channel. The supporting angle or channel shall be supported by MS rods with threads. Steel anchor fasteners shall be provided by contractor for duct hanging (wherever required). Anchor fasteners shall be loaded to maximum 20% of the maximum rated capacity specified by the manufacturer, engineer in charge shall approve all anchor fasteners used for supporting duct.</li> <li>6) The size of angle and round rod above are indicative of general requirement. However higher sizes of MS angle and MS rod shall be provided for duct supports if required. Lock nuts (double nuts) shall be provided to each MS rods supporting the ducts, lock nuts (double nuts) shall be provided to each GI rods supporting the ducts.</li> <li>7) All bends offsets and branch connections shall be made for smooth and noise less flow of air and minimum pressure drop. In case of full radius elbow optimum ratio of centreline radius of elbow to duct dimension of 1.25 shall be considered. However due to space constraint shorter radius shorter radius elbow or square elbow with guide vanes may be provided contractor shall furnish the details of guide vanes i.e. Number of vanes, Location etc., in the drawing.</li> <li>8) All curved elbows shall be provided with air turning vanes consists of curved metal blades of vanes arranged so as to permit the air to make abrupt turns without appreciable turbulence.</li> </ol>
4	<p><b>INSULATION</b></p> <p>Supply, installation of 19 mm thick Class "O" Insulation with one side Aluminium faced. The Insulation Material should be FM Approved. The insulation should have fire performance such that it passes Class 'O' as per BS 476 Part 6 for Fire Propagation and Class 1 as per BS 476 Part 7 for surface spread of flame. All insulation joints (including Flange joints) to be sealed with 3" width Self Adhesive tape. All the exposed ducts shall be aluminium cladded 0.5 mm thick for protection against rain and other extreme atmospheric conditions.</p>
5	<p><b>FIRE DAMPERS</b></p> <ol style="list-style-type: none"> <li>1) The damper should be multi blade louvre type. The blades should remain in the air stream in open position and should be constructed with minimum 1.8 mm thick galvanised sheets. The frame should be of 1.6 mm thickness. Other materials should include locking device, motorised actuator, control panel to trip AHU motor etc.</li> <li>2) The fire dampers shall be capable of operating automatically on receiving signal from a fire alarm panel. All control wiring should be provided between fire damper and electric panel.</li> <li>3) A hinged and gasketed access panel measuring at least 450 mm x 450 mm should be provided on duct work before each reheat coil and at each control device that may be located inside the duct work.</li> </ol>
6	<p><b>ELECTRICAL</b></p> <ol style="list-style-type: none"> <li>1) General Design Consideration             <ol style="list-style-type: none"> <li>a) System configuration                 <ol style="list-style-type: none"> <li>i. Voltage Supply: 415V<math>\pm</math> 10%</li> <li>ii. Frequency :50Hz<math>\pm</math> 5%</li> <li>iii. No of Phase and grounding: 3 Phase &amp; Solidly ground earth</li> <li>iv. Power Distribution: A.C., 3 Phase 4 wire for 3 Phase system, 1 Phase 3 wire system</li> </ol> </li> <li>b) Code &amp; Standards</li> </ol> </li> </ol>

	<p>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.</p> <ol style="list-style-type: none"> <li>2) Cabling for electrical supply from wall mounted electrical panel to respective AHUs/Chillers/Pumps/Humidifier/Exhaust Blower shall be armoured copper cables.</li> <li>3) Copper lugs should be used for cable termination.</li> <li>4) Bus bar for incoming should be of Copper.</li> <li>5) Cabling for all the equipment shall be laid through GI ladder or conduit.</li> <li>6) AHU blower should operate on VFDs</li> <li>7) Heaters control should be through SCR</li> <li>8) Star-delta starter for chilled water pumps</li> <li>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 &amp; Strip heater system and SCR for Heater controllers. Provision for :             <ol style="list-style-type: none"> <li>a) AHU(Heaters, Blower, Humidifier)</li> <li>b) Pumps.</li> </ol> </li> <li>10) AHU panel Interlocks             <ol style="list-style-type: none"> <li>a. Flow Switch- 1nos</li> <li>b. AHU Door interlock- 1 nos</li> <li>c. Smoke and Fire- 1nos</li> <li>d. Thermal Interlock- 1nos</li> <li>e. Access control Emergency interlock- 1nos.</li> </ol> </li> </ol>
7	<p><b>Exhaust Ducting and Blower</b> <b>Blowers should be FRP moulded and ducting shall be PP+FRP</b></p>
8	<p><b>DUCTING MODIFICATION</b></p> <ol style="list-style-type: none"> <li>1) HVAC Ducting modification</li> <li>2) Electrical Modification</li> <li>3) Exhaust Ducting modification</li> <li>4) Compressed air Modification.</li> <li>5) Chilled water modification</li> </ol>
9	<p><b>CIVIL WORKS</b></p> <p>Making cut-outs/ penetrations etc. for routing ducts etc. in the building and making good the same with painting is in the vendor's scope of work.</p>
10	<p><b>CLEAN ROOM VALIDATION</b></p> <p>The Contractor should validate the Cleanroom as per ISO 14644. Documents to be submitted along with validation reports, test certificate for equipment/materials and detailed engineering drawing.</p>
11	<p><b>RECOMMENDED MAKES FOR HVAC</b></p>



S.NO	DESCRIPTION	RECOMMENDED MAKES
1.	Air Handling units	CITIZEN / VTS / FLAKTWOODS SYSTEMAIR/ZECO
2	Motors for AHU	CROMPTON/GREAVES/ABB/SIEMENS/SCHNIDER
3	Chillers	Daikin, Trane
4	Starter	Siemens/ABB/L&T/SCHNEIDER
5	Fire Dampers	Air Master/Caryaire/Ajanta/System Air/Cosmos
6	Pan type humidifier	RAPID COOL/NORDAMANN/Walter Meier/Appidi
7	Ducting – GI Sheets	SAIL/TATA/Jindal
8	Duct Insulation	ARMAFLEX/K FLEX/SUPREME/AEROFLEX/ TROCELLENE
9	Butterfly and Ball valves	Regin/Siemens
10	3 Way /2 way Mixing Valve	Honeywell/Siemens/Johnson/Belimo/Regin
11	Balancing Valve	L&T/Advance/Bell & Gossett/Tour & Anderson
12	Y- Strainer	Sant /DS Engg/Lehry
13	Pumps	Johnson/ Grundfos /Armstrong
14	Pipe SS	TATA/Ratanamani/Jindal
15	Pressure and Temperature gauges	WIKA/FORBE MARSHALL/HGURU/WAREE

**(Note: It is mandatory for the bidders to provide the compliance statement in tabular column format along with catalogue page number**

**(comply/not comply) for the Above points with document proof as required. Failing which bidders will be technically disqualified)**