



INDIAN INSTITUTE OF TECHNOLOGY MADRAS
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The Manager (Project Purchase)

Date: 21.09.2022

Open Tender Reference No: EE/AMIT/043/2022/CLEANROOMHVAC

GEM NAR ID: GEM/GARPTS/06092022/F5JRMBBXYFQ3

Due Date/Time: 11.10.2022@ 3:00 PM

Dear Sir/Madam,

On behalf of the Indian Institute of Technology Madras, Tenders are invited in two bid system from Class-I local suppliers and Class II local suppliers, for the supply of: **“CLEAN ROOM HVAC UPGRADATION WORK”** Conforming to the specifications given in **Annexure -A**.

Tender Documents may be downloaded from Central Public Procurement Portal <https://etenders.gov.in/e procure/app>. Aspiring Bidders who have not enrolled / registered in e-procurement should enroll / register before participating through the website <https://etenders.gov.in/e procure/app>. The portal enrolment is free of cost. Bidders are advised to go through instructions provided at **“Help for contractors”**. [Special Instructions to the Contractors/Bidders for the e-submission of the bids online through this eProcurement Portal”]

Bidders can access tender documents on the website (For searching in the NIC site, kindly go to Tender Search option and type ‘IIT’. Thereafter, click on “GO” button to view all IIT Madras tenders). Select the appropriate tender and fill them with all relevant information and submit the completed tender document online on the website <https://etenders.gov.in/e procure/app> as per the schedule attached.

1)	Pre-bid Meeting Details	:	NA
2)	ICSR Vendor Registration	:	<p><u>Vendor registration code.</u> Vendor registration with IC&SR (IITM) is mandatory for bidders to participate in tenders.</p> <p>** <u>For Vendor Registration & Guidelines, Please follow the website :</u> https://icandsr.iitm.ac.in/vendorportal; Helpdesk: vendorhelpdesk@icsrpis.iitm.ac.in</p>

No manual bids will be accepted. All tender documents including Technical and Financial bids should be submitted in the E-procurement portal.

Last date for receipt of tender	:	11.10.2022 @ 3:00 PM
Date & time of opening of tender	:	12.10.2022 @ 3:00 PM

3. Instructions to the Bidder:

<p><u>A)</u></p>	<p>Searching for tender documents</p>	<p>:</p>	<ul style="list-style-type: none"> • There are various search options built in the CPP Portal, to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, organization name, location, date, value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as organization name, form of contract, location, date, other keywords etc. to search for a tender published on the CPP Portal. • Once the bidders have selected the tenders they are interested in, they may download the required documents / tender schedules. These tenders can be moved to the respective “My Tender” folder. This would enable the CPP Portal to intimate the bidders through SMS / email in case there is any corrigendum issued to the tender document. • The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification / help from the Helpdesk.
<p><u>B)</u></p>	<p>Assistance to bidders</p>	<p>:</p>	<ul style="list-style-type: none"> • Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated in the tender. • Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to the 24x7 CPP Portal Helpdesk. The contact number for the helpdesk is [0120-4200462, 0120-4001002, 0120-4001005]
<p><u>C)</u></p>	<p>Enrollment Process to Bidders</p>	<p>:</p>	<p><u>REGISTRATION</u></p> <ul style="list-style-type: none"> • Bidders are required to enroll on the e-Procurement module of the Central Public Procurement Portal URL:https://etenders.gov.in/eprocure/app by clicking on “Online Bidder Enrollment”. Enrollment on the CPP Portal is free of charge. • As part of the enrolment process, the bidders will be required to choose a unique username and assign a password for their accounts. • Bidders are advised to register their valid email address and mobile numbers as part of the registration process. These would be used for any communication from the CPP Portal. • Upon enrolment, the bidders will be required to register their valid Digital Signature Certificate (Class II or Class III Certificates with signing key usage) issued by any Certifying Authority recognized by CCA India (e.g. Sify / TCS / nCode / eMudhra etc.) • Only one valid DSC should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their DSCs to others which may lead to misuse. • Bidder then may log in to the site through the secured log-in by entering their user ID / password and the password of the DSC / eToken. • Possession of a Valid Class II/III Digital Signature Certificate

			<p>(DSC) in the form of smart card/e-token in the company's name is a prerequisite for registration and participating in the bid submission activities through https://etenders.gov.in/eprocure/app</p> <ul style="list-style-type: none"> • Digital Signature Certificates can be obtained from the authorized certifying agencies, details of which are available in the web site https://etenders.gov.in/eprocure/app under the “Information about DSC”.
<u>D)</u>	Preparation of bids	:	<ul style="list-style-type: none"> • Bidder should take into account any corrigendum published on the tender document before submitting their bids. • Please go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the bid documents have to be submitted, the number of documents including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid. • Bidder, in advance, should prepare the bid documents to be submitted as indicated in the tender document / schedule and generally shall be in PDF / XLS formats as the case may be. Bid documents may be scanned with 100 dpi with black and white option. • To avoid the time and effort required in uploading the same set of standard documents which are required to be submitted as a part of every bid, a provision of uploading such standard documents (e.g. PAN card copy, GSTIN Details, annual reports, auditor certificates etc.) has been provided to the bidders. Bidders can use “My Documents” area available to them to upload such documents. These documents may be directly submitted from the “My Documents” area while submitting a bid, and need not be uploaded again and again. This will lead to a reduction in the time required for bid submission process.
<u>E)</u>	Submission of bids	:	<ul style="list-style-type: none"> • Bidder should log into the site well in advance for bid submission so that he/she can upload the bid in time i.e. on or before the bid submission date and time. Bidder will be responsible for any delay due to other issues. • The bidder has to digitally sign and upload the required bid documents one by one as indicated in the tender document. • Bidder has to select the bid security declaration. Otherwise, the tender will be summarily rejected. • A standard BOQ format has been provided with the tender document to be filled by all the bidders. Bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. Bidders are required to download the BOQ file, open it and complete the detail with their respective financial quotes and other details (such as name of the bidder). If the BOQ file is found to be modified by the bidder, the bid will be rejected. • The server time (which is displayed on the bidders’ dashboard) will be considered as the standard time for referencing the deadlines for submission of the bids by the bidders, opening of bids etc. The

		<p>bidders should follow this time during bid submission.</p> <ul style="list-style-type: none"> • The Tender Inviting Authority (TIA) will not be held responsible for any sort of delay or the difficulties faced during the submission of bids online by the bidders due to local issues. • The uploaded tender documents become readable only after the tender opening by the authorized bid openers. • Upon the successful and timely submission of bids, the portal will give a successful bid submission message & a bid summary will be displayed with the bid no. and the date & time of submission of the bid with all other relevant details. • Kindly add scanned PDF of all relevant documents in a single PDF file of compliance sheet. • More information useful for submitting online bids on the CPP Portal may be obtained at: https://etenders.gov.in/eprocure/app. • All tender documents including pre-qualification bid, Technical Bid & Financial Bid should be submitted separately in online CPP portal as per the specified format only. Right is reserved to ignore any tender which fails to comply with the above instructions. No manual bid submission will be entertained.
F)	Marking on Technical Bid	<ul style="list-style-type: none"> • The bidder eligibility criteria, technical specification and supply of item for this tender is given in Annexure A. • The Bidders shall go through the specification and submit the technical bid. • The Technical bid should be submitted in the proforma as per Annexure-B in pdf format only through online (e-tender). No manual submission of bid will be entertained. • The technical bid should have a page-wise heading as “Technical Bid” and page no. in all pages with seal and signature of authorized signatory. The total no. of pages should be mentioned at the last page of the documents. • The technical bid should consist of bidder eligibility criteria details and all technical details along with catalogue/ pamphlet which will give a detailed description of product with technical data sheet so that technical compliance can be verified.
G)	Marking on Price Bid	<ul style="list-style-type: none"> • Financial bid (BoQ) should be submitted in the prescribed proforma format as per Annexure-C in xls format through e-tender only. No manual or other form of submission of Financial Bid will not be entertained

4)	<p>Preparation of Tender: The bidders should submit the bids in two bid system as detailed below.</p> <p>Bid I _Technical Bid</p> <p>The technical bid should consist of bidder eligibility criteria and technical specification compliance sheet as per Annexure-B.</p> <p>Bid II _Price Bid</p> <p>The price bid should be submitted in excel format (BoQ) as per the proforma (Annexure C) uploaded in the e-Tender web site. The Quoted price should be for supply and installation of the item and inclusive of all cost and statutory levies at IIT Madras.</p>
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5)	<p>Price:</p> <ul style="list-style-type: none"> a) The price should be quoted only in INR net per unit (after breakup) and must include all packing, transit insurance and delivery charges to the Department of Electrical Engineering. b) The rate quoted shall be all inclusive of all taxes and no extra payment will be made other than statutory revisions as per the terms and conditions stipulated in this contract document. c) The percentage of tax & duties should be clearly indicated separately. IIT Madras is eligible for custom duty (5.5%). Relevant certificates will be issued wherever necessary. d) The offer/bids should be submitted through online only in two bid system i.e. Technical Bid and Financial Bid separately.
6)	<p>Tenderer shall submit along with this tender:</p> <ul style="list-style-type: none"> (i) Proof of having ISO or other equivalent certification given by appropriate authorities. (ii) Name and full address of the Banker and their swift code and PAN No. and GSTIN number. (iii) GST registration proof showing registration number, area of registration etc. (iv) All of your future correspondences including Invoices should bear the GST No. and Area Code.
7)	<p>Terms of Delivery:</p> <p>Supplier will be fully responsible for the safe carriage, Installation/Commissioning of goods up to the Department of Electrical Engineering, IIT Madras or named place as per PO, Insurance coverage will be in the scope of the supplier.</p> <p>The tenderer should indicate clearly the time required for delivery of the item (subject to the approval of the Executive Committee-IIT-Madras). In case there is any deviation in the delivery schedule, liquidated damages clause will be enforced or penalty for the delayed supply period will be levied.</p> <p>In the event of delay or non-supply of materials/execution of Contract beyond the date of delivery/completion of job. The penalty will be levied @1% per week of delay subject to a max of 10% of the value of purchase order and if the delay is more than accepted time frame by IIT M, the PO would be partially or fully cancelled and liquidated damages will be enforced accordingly.</p>
8)	<p>Period for which the offer will remain open:</p> <p>The Tender shall remain open for acceptance/validity till: 120 days from the date of opening of the tender. However, the day up to which the offer is to remain open being declared closed holiday for the Indian Institute of Technology Madras, the offer shall remain open for acceptance till the next working day.</p>
9)	<p>EMD:</p> <p>The EMD of Rs. 1,40,000 to be transferred to the account details mentioned in Annexure D and proof should be enclosed in the Technical Bid. Any offer not accompanied with the EMD shall be rejected summarily as non-responsive.</p> <p>The EMD of the unsuccessful bidders shall be returned within 30 days of the end of the bid validity period. The same shall be forfeited, if the tenderers withdraw their offer after the opening during the bid validity period. The Institute shall not be liable for payment of any interest on EMD.</p> <p>EMD is exempted for Micro and Small Enterprises (MSE) as defined in MSE Procurement Policy issued by Department of Micro, Small and Medium Enterprises (MSME) and Startups as recognized by Department of Industrial Policy & Promotion (DIPP). (MSE/MSME/DIPP PROOF should be enclosed in the cover containing technical bid).</p>

10)	<p>Performance Security: -</p> <p>The successful bidder should submit Performance Security for an amount of 3% of the value of the contract/supply. The Performance Security may be furnished in the form of an Account Payee DD, FD Receipt in the name of “The Registrar, IIT Madras” from any scheduled commercial bank or Bank Guarantee from any scheduled commercial bank in India. The performance security should be furnished within 14 days from the date of the purchase order.</p> <p>Performance Security in the form of Bank Guarantee: - In case the successful bidder wishes to submit Performance Security in the form of Bank Guarantee, the Bank Guarantee should be routed directly to IIT Madras from the Bank.</p> <p>The Bank Guarantee should remain valid for a period of sixty days beyond the date of completion of all contractual obligations of the supplier including the warranty obligations.</p>
11)	For the same tender, either the OEM or the authorized dealer/service provider can only quote. But both of them cannot quote separately for the same tender.
12)	The offers/bids should be sent only for a item/Equipments of latest version that is available in the market and supplied to a number of customers. A list of customers in India with details must accompany the quotations. Quotations for a prototype machine will not be accepted
13)	Original catalogue (not any photocopy) of the quoted model duly signed by the principals must accompany the quotation in the Technical bid.
14)	Compliance or Confirmation report with reference to the specifications and other terms & conditions should also be obtained from the principal/OEM.
15)	<p>Risk Purchase Clause</p> <p>In the event of failure of supply of the item/equipment within the stipulated delivery schedule, the purchaser has all the right to purchase the item/equipment from other sources on the total risk of the supplier under risk purchase clause.</p>
16)	<p>Payment:</p> <p>(i) No Advance payment will be made. However, 90% Payment against Delivery and 10% after installation are agreed to wherever the installation is involved.</p> <p>(ii) Advance Payment: No advance payment is generally admissible. In case a specific percentage of advance payment is required, the Vendor has to submit a Bank Guarantee from a scheduled commercial bank in India equivalent to the amount of advance payment.</p>
17)	<p>On-site Installation:</p> <p>The equipment/item or Machinery has to be installed or commissioned by the successful bidder within the number of days (as prescribed by PI) from the date of receipt of the item at the site of IIT Madras.</p>
18)	<p>Warranty/Guarantee:</p> <p>The offer should clearly specify the warranty or guarantee period for the machinery/equipment. Any extended warranty offered for the same has to be mentioned separately (For more details please refer our Technical Specifications).</p> <p>** Note: PO which involves installation, warranty/guarantee shall be applicable from date of installation.</p>
19)	<p>Acceptance and Rejection:</p> <p>Failure to comply with any of the instructions stated in this document or offering unsatisfactory explanations for non-compliance will likely to lead to rejection of offers.</p> <p>I.I.T. Madras has the right to accept the whole or any part of the Tender or portion of the quantity offered or reject it in full without assigning any reason.</p>

20)	<p>Debarment from Bidding:</p> <p>In case of breach of Terms & Conditions, Bidder may be suspended from being eligible for bidding in any contract with the IIT Madras up to 2 Years [as per Rule 151(iii) of GFR] from the date of Tender.</p>
21)	<p>Disputes and Jurisdiction:</p> <p>Settlement of Disputes: Any dispute, controversy or claim arising out of or in connection with this PO including any question regarding its existence, validity, breach or termination, shall in the first instance be attempted to be resolved amicably by both the Parties. If attempts for such amicable resolution fails or no decision is reached within 30 days whichever is earlier, then such disputes shall be settled by arbitration in accordance with the Arbitration and Conciliation Act, 1996. Unless the Parties agree on a sole arbitrator, within 30 days from the receipt of a written request by one Party from the other Party to so agree, the arbitral panel shall comprise of three arbitrators. In that event, the supplier will nominate one arbitrator and the Project Coordinator of IITM shall nominate an arbitrator. The Dean IC&SR will nominate the Presiding Arbitrator of the arbitral tribunal. The arbitration proceeding shall be carried out in English language. The cost of arbitration and fees of the arbitrator(s) shall be shared equally by the Parties. The seat of arbitration shall be at IC&SR IIT Madras, Chennai.</p> <p>a. The Applicable Law: The Purchase Order shall be construed, interpreted and governed by the Laws of India. Court at Chennai shall have exclusive jurisdiction subject to the arbitration clause.</p> <p>b. Any legal disputes arising out of any breach of contract pertaining to this tender shall be settled in the court of competent jurisdiction located within the city of Chennai in Tamil Nadu.</p>
22)	<p>Force Majeure: The Supplier shall not be liable for forfeiture of its performance security, liquidated damages or termination for default, if and to the extent that, its delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure.</p> <p>For purposes of this Clause, “Force Majeure” means an event beyond the control of the Supplier and not involving the Supplier’s fault or negligence and not foreseeable. Such events may include, but are not limited to, acts of the Purchaser either in its sovereign or contractual capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions and freight embargoes.</p> <p>If a Force Majeure situation arises, the Supplier shall promptly notify the Purchaser in writing of such conditions and the cause thereof. Unless otherwise directed by the Purchaser in writing, the Supplier shall continue to perform its obligations under the Contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event.</p>
23)	<p>Eligibility Criteria:</p> <ul style="list-style-type: none"> ➤ As per the Government of India Order, only “Class - I Local Suppliers” and “Class - II Local Suppliers” can participate in this tender. ➤ <u>Bidder should confirm their acceptance that they comply with the provisions with report to “Guidelines for eligibility of a bidder from a country which shares a land border with India as detailed at Annexure-F. The bidder should submit Certificate for “Bidder from/ Not from Country sharing Land border with India & Registration of Bidder with Competent Authority” as per Order of DoE F.No.6/18/2019-PPD dated 23.07.2020 as mentioned.</u>
24)	<p>Preference to “class I Local Suppliers”: preference will be given to “class 1 local suppliers” (subject to class -I local supplier’s quoted price falling within the margin of purchase preference) as per public procurement (preference to make in India) order 2017 .O.M No P- 45021/2/2017 – pp(BE - 11) dt 04/06/2020 subject to the conditions that the “class 1 Local Supplier” should agree to supply goods / provide service at L1 rate and furnish a certificate with the technical bid document that the goods/service provided by them consists local content equal to or more than 50%.(certificate from</p>

	<p>Chartered Accountant in case value of contract exceeds Rs 10 crore).</p> <ul style="list-style-type: none"> ➤ ‘Class - I local supplier’ means a supplier or service provider whose goods, services or works offered for procurement consists of local content equal to or more than 50% as defined under the above said order. Declaration to be provided as per Annexure-II per item/service/work. ➤ ‘Class - II local supplier’ means a supplier or service provider whose goods, services or works offered for procurement consists of local content equal to 20% but less than 50% as defined under the above said order. Declaration to be provided as per Annexure-II per item/service/work. ➤ ‘Margin of purchase preference’: - The margin of purchase preference shall be 20%. The Definition of the margin of purchase preference is defined in the Govt. of India Order No: P-45021/12/2017-PP (BE-II) Dt.4th June, 2020) Order 2017. As per the Government of India Order – “Margin of Purchase Preference” means the maximum extent to which the price quoted by a “Class-I local supplier” may be above the L1 for the purpose of purchase preference. <p>**Note: Local content percentage to be calculated in accordance with the definition provided at clause 2 of revised public procurement preference to Make in India Policy vide GoI Order no. P-45021/2/2017-PP (B.E.-II) dated 15.06.2017 (subsequently revised vide orders dated 28.05.2018, 29.05.2019 and 04.06.2020) MOCI order No. 45021/2/2017-PP (BE II) Dt.16th September 2020 & P-45021/102/2019-BE-II-Part(1) (E-50310) Dt.4th March 2021</p>
25)	<p>Evaluation of Bids</p> <p>Bid evaluation will take place in two stages.</p> <p>Stage I Technical Bid evaluation</p> <p>All bidders who have fully complied with bidder eligibility criteria I, II and technical evaluation (Annexure A) will only be considered for opening of price bid.</p> <p>Stage II: Price Bid Evaluation</p> <p>The price bid evaluation will be based on price quoted by the bidder. The rate quoted for CLEAN ROOM HVAC UPGRADATION WORK unit will alone be taken up for arrival of Lowest Bid (L1) value.</p>
26)	<p>Selection of successful bidder and Award of Order</p> <p>The order will be directly awarded to the technically qualified bidder as per the condition in para 3A of DIPP, MoCI Order No. 45021/2/2017-PP (BE II) dated 16th September 2020.</p>
27)	<p>All information including selection and rejection of technical or financial bids of the prospective bidders will be communicated through e-Tender portal. In terms of Rule 173(iv) of General Financial Rule 2017, the bidder shall be at liberty to question the bidding conditions, bidding process and/or rejection of bids.</p>
28)	<p>The tenderer shall certify that the tender document submitted by him / her are of the same replica of the tender document as published by IIT Madras and no corrections, additions and alterations made to the same. If any deviation found in the same at any stage and date, the bid / contract will be rejected / terminated and actions will be initiated as per the terms and conditions of the contract.</p>
29)	<p>Due to Covid-19 pandemic pre-bid meeting will be conducted through online. Clarification to the queries and doubts raised by the bidders will be issued as a corrigendum/addendum in the e-tenders portal.</p>
30)	<p>Due to Covid-19 pandemic the bidders will not be entertained to participate in opening of Bids. Since the tender is e-tender, the opening of the bids may be checked using the respective logins of the bidders.</p>

ACKNOWLEDGEMENT

It is hereby acknowledged that I/We have gone through all the points listed under “Specification, Guidelines, Terms and Conditions” of tender document. I/We totally understand the terms and conditions and agree to abide by the same.

**SIGNATURE OF TENDERER ALONG WITH SEAL OF
THE COMPANY WITH DATE**

Bidder Eligibility Criteria and Technical Specification for CLEAN ROOM HVAC UPGRADATION WORK

Tender No. EE/AMIT/043/2022/CLEANROOMHVAC

Bidder Eligibility Criteria – I (Public Procurement – Preference to Make in India)

Only 'Class-I local suppliers' and 'Class-II local suppliers', as defined under DIPP, MoCI Order No. P-45021/2/2017-PP (BE-II) dated 16th September 2020 and other subsequent orders issued therein.

Bidder Eligibility Criteria – II

- a) The bidder should have executed minimum 5 similar nature of projects i.e., Class-100 or Class-1000 Semiconductor Clean rooms at IITs, NITs, IISERs, CSIR Labs or other Govt. R&D organizations in the last 10 years, and Relevant PO/Installation certificates for the similar type of work executed should be provided
- b) Bidder should be ISO and CE certified.

III. TECHNICAL SPECIFICATION for CLEAN ROOM HVAC UPGRADATION WORK

Centre for NEMS and Nanophotonics (CNNP) was established in the year 2011 – A part of Microelectronics & MEMS laboratory which is a semiconductor fabrication lab in the Electrical Engineering Department. Many sophisticated Chip Fabrication and Characterization tools are housed inside. We are planning to install some Additional equipment's inside the same clean room. Since, the capacity of existing clean room HVAC system is not sufficient to handle the additional load, it is proposed to upgrade the existing HVAC system. The upgraded HVAC system should maintain below condition inside both the clean rooms.

- a) Temperature: $22 \pm 1^{\circ}\text{C}$
- b) Relative Humidity: $45 \pm 5\%$

IITMadras will provide the Chilled water at $8 \pm 1^{\circ}\text{C}$ and flow rate of 700 LPM with 3 bar pressure

The schematic for the HVAC upgradation facility is attached in the Annexure-1. The detail scope of work is as follows,

- 1) Design, Supply & installation of 2 Nos. of Air Handling Unit (AHU), for Class1000 and Class 100 clean rooms.
- 2) Supply & installation of interfacing Pipe line including fittings, valve, etc for AHU's.
- 3) Supply & installation of Ducting from AHU's to clean room as per requirements including any modification if required for existing ducting.
- 4) Disconnecting of existing Class 100 clean room AHU and connect to the CNNP grey area with suitable ducting and fresh air provision from atmosphere.
- 5) Supply & installation of Exhaust blower for wet benches including PP-FRP ducting.
- 6) Supply & installation of Electrical & instrumentation controls for the facility.
- 7) Validation of class 100 & class 1000 clean room after commissioning of HVAC upgradation work.

S.NO	SPECIFICATION
1.	<p><u>AIR HANDLING UNIT (AHU) (Quantity- 2No)</u></p> <p>Scope of work included design, supply, installation and commissioning of 1 Nos. 8647 CFM capacity Air handling unit for class 1000 clean room facility and 1 Nos. 5076 CFM capacity AHU for class 100 clean room facility.</p> <p>A) Specification of the Air Handling Unit (AHU) for class 1000 clean room is given below:</p> <ol style="list-style-type: none"> a. Total Supply air = 4.081 M3/sec b. Return air =1.478 m3/sec c. Fresh air =2.603 m3/sec d. Total fan Static =150mm WG e. Cooling Coil Capacity =53 Tr. f. Heater capacity= 57 kW g. Humidification Duty =2.9 Kg/hr <p>B) Specification of the Air Handling Unit (AHU) for class 100 clean room is given below:</p> <ol style="list-style-type: none"> a. Total Supply air = 2.396 M3/sec b. Return air =1.736 m3/sec c. Fresh air =0.66 m3/sec d. Total fan Static =150 mm WG e. Cooling Coil Capacity =19 Tr. f. Heater Capacity= 33 kW g. Humidification duty:1.25 Kg/Hr
1.1	<p>AHU CASING</p> <ol style="list-style-type: none"> 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. 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. 3) The framework for each section shall be joined together with soft rubber gasket in between to make joints air tight. 4) Suitable air tight access doors with Aluminium die cast heavy duty hinges and locks shall be provided for various sections. 5) The casing shall incorporate thermal break profile and all other necessary design features to ensure that condensation does not occur during all seasons. 6) The AHUs shall be having Sound attenuators at Suction and delivery of AHUs to reduce the sound to 70+2 dB (A).
1.2	<p>CIRCULATION FAN</p> <ol style="list-style-type: none"> 1) Fan Type: Direct driven, Plug type high efficiency centrifugal fan 2) Desired noise level should be reduced to 70+5 dB (A) or less by suitable sound attenuators on supply and return air path. 3) Required Total static pressure: 150 ± 2 mm WG. 4) Fans should have backward curved blades to improve efficiency. 5) Fan blades should be made of Aluminium alloy for stability. 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. 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. 8) The motor should be of high Efficiency IE3 class as per IS 12615 – 2011- Non FLP. 9) Motor should be compatible for VFD operation. 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

	<p>interference with the free operation of the fan vibration system.</p> <ol style="list-style-type: none"> 11) Fan should be factory statically and dynamically balanced as required to achieve field balance levels. 12) Epoxy based coating shall be provided on all the surfaces of ferrous fan housing. 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. 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.
1.3	<p>COOLING COILS</p> <ol style="list-style-type: none"> 1) Cooling medium requirement: Chilled water at a temperature of $8 \pm 1^{\circ}\text{C}$ 2) The velocity across the cooling coils should not exceed 2.25 m/s. accordingly, cooling coil area should be selected. 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. 4) Copper tubes should be $25 \pm 5\%$ SWG and hydrostatically tested for 21 kg per sq. cm. 5) Cooling coil condensate tray should be of $14 \pm 5\%$ SWG SS 304 material. 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. $\text{m}^2 \text{O C/K cal}$ 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.
1.4	<p>HEATERS</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"> 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, airstat in redundant arrangement along with all control devices which will be controlled by thyristors
1.5	<p>HUMIDIFIER</p> <ol style="list-style-type: none"> 1) Type: Pan type, Electrical heating 2) Humidification capacity: Sufficient capacity to maintain the required RH levels inside the cleanrooms in the dry season. 3) For calculating humidification by the above humidifier so as to maintain dew point temperature of the treated fresh air at $12.5 \pm 0.5 \text{ Deg C}$, an outside peak winter temperature as per the outdoor condition to be considered.
1.6	<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. • 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 600mm x 600mm (preferably). <ol style="list-style-type: none"> 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. 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. 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 < 15 mm of WG. Accessories Requirement: Frame, supports, sealing gasket (Neoprene gasket pasted on the back side of the flange), quick release mechanism.
1.7	<p>CHILLED WATER PIPING</p> <ol style="list-style-type: none"> 1) The line shall be of SS 304 SCH 10 pipes. 2) Booster pumps with one working and one stand-by arrangement (for each AHU) shall be provided in the chilled

	<p>water line.</p> <ol style="list-style-type: none"> 3) The line shall be complete with all the fittings like valves, flanges, bends etc. 4) The flanges shall be SS heavy duty (rating PN 16). 5) The gaskets shall be good quality neoprene of appropriate thickness. 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. 7) The temperature gauges of suitable range shall be 4 inches dial type. The sensor, capillary and thermo-well shall be SS316. 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. 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. 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. 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.
<p>1.7.1</p>	<p>BUTTERFLY VALVE</p> <ol style="list-style-type: none"> 1) The butterfly valve should be CI/SG body with EPDM liner and SS316 disc preferably in two piece Construction. 2) The disc should consist of disc pivot and driving stem shall be in one piece centrally located. 3) The valve seat should be synthetic material suitable for water duty. It shall line the whole body. 4) The disc should move in slide bearings on both ends with ‘o’ ring to prevent leakage. 5) The handle should have arrangement for locking in any set position. 6) All valves 200mm Dia. and above should be gear operated. 7) The valve should be suitable for 16 Kg/cm² working pressure.
<p>1.7.2</p>	<p>BALL VALVE</p> <ol style="list-style-type: none"> 1) All Valves 40 mm Dia. and below should be of SS304 single piece type PN 16 rated. 2) Ball type Valves with (FPT) female threads conforming to class 2 of IS 778 and mating flanges fitting. 3) All Ball valves should be ISI Marked.
<p>1.7.3</p>	<p>3 WAY MODULATING VALVE</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>
<p>1.7.4</p>	<p>DUAL PLATE CHECK VALVE</p> <ol style="list-style-type: none"> 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>1.7.5</p>	<p>STAINERS</p> <ol style="list-style-type: none"> 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.

1.7.6	<p>JOINING</p> <ol style="list-style-type: none"> 1) 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.
1.7.7	<p>PIPE SUPPORTS/HANGERS</p> <ol style="list-style-type: none"> 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.
1.7.8	<p>TESTING</p> <ol style="list-style-type: none"> 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/cm² 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.
1.8	<p>CHILLED WATER PUMPS</p> <ol style="list-style-type: none"> 1) Quantity – 2 Nos.(1 W+ 1S) 2) Pump flow rate: 550LPM @ 3 Kg/cm² 3) Pump type: Horizontal centrifugal pumps. 4) Heavy duty for continuous operation 5) MOC: 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.
1.9	<p>INSTRUMENTATION & CONTROL</p> <ol style="list-style-type: none"> 1) Three-way flow control valve, complete with all the accessories and with a manual bypass line with an isolation valve. 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. 3) Cooling coil water inlet and outlet temperature sensor cum transmitter. 4) Pressure gauges with isolation ball valves at inlet and outlet of the coils. Temperature gauges with thermowells. 5) Pressure gauges with isolation ball valves at inlet and outlet of all the pumps 6) Differential pressure sensor across pre filters and fine filters. 7) VFDs for AHU fans. 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.

<p>2</p>	<p>DUCTING</p> <p>Ducts shall comprise of factory fabricated uninsulated GI sheet metal ducting with zinc deposition of 120 gm/m² 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.</p> <p>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> <ul style="list-style-type: none"> a) 18 G (1.27 mm thick) suitable for > 50 inch diagonal ducts b) 20 G (0.95 mm thick) for > 40 inch ducts c) 22 G (0.8 mm thick) for > 30 inch ducts d) 24 G (0.64 mm thick) for > 20 inch ducts <p>Construction Features (applicable only for factory fabricated ducts):</p> <ol style="list-style-type: none"> 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. 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. 3) To avoid leakage silicone sealant shall be used and leakage from duct joints shall be minimum (3 to 5%). 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). 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(whenever 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. 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. 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. 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.
<p>2.1</p>	<p>INSULATION</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 clad 0.5 mm thick for protection against rain and other extreme atmospheric conditions.</p>
<p>3</p>	<p>FIRE DAMPERS</p> <ol style="list-style-type: none"> 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. 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. 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.

<p>4</p>	<p>ELECTRICAL</p> <p>1) General Design Consideration</p> <p>a) System configuration</p> <p>i. Voltage Supply: 415V± 10%</p> <p>ii. Frequency :50Hz± 5%</p> <p>iii. No of Phase and grounding: 3 Phase & Solidly ground earth</p> <p>iv. Power Distribution: A.C., 3 Phase 4 wire for 3 Phase system, 1 Phase 3 wire system</p> <p>b) Code & Standards</p> <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> <p>2) Cabling for electrical supply from wall mounted electrical panel to respective AHUs/Pumps/Humidifier shall be armoured copper cables.</p> <p>3) Copper lugs should be used for cable termination.</p> <p>4) Bus bar for incoming should be of Copper.</p> <p>5) Cabling for all the equipment shall be laid through GI ladder or conduit.</p> <p>6) AHU blower should operate on VFDs</p> <p>7) Heaters control should be through SCR</p> <p>8) Star-delta starter for chilled water pumps</p> <p>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.</p> <p>Provision for :</p> <p>a) AHU(Heaters, Blower, Humidifier)</p> <p>b) Pumps.</p> <p>10) AHU panel Interlocks</p> <p>a. Flow Switch- 1nos</p> <p>b. AHU Door interlock- 1 nos</p> <p>c. Smoke and Fire- 1nos</p> <p>d. Thermal Interlock- 1nos</p> <p>e. Access control Emergency interlock- 1nos.</p>
<p>5</p>	<p>BMS</p> <p>Dedicated HVAC BMS system with HMI panel shall be with the following I/O's</p>

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	PPM Fluoride	HF&Acid /Alkaline level	
		S/N	System																																	
CONTROL PANEL		0																																		
1.0	CHILLER	0	0																																	
2.0	CHILLER PUMP	2	2							0	2	2																								
3.0	AHU	2	2	2	2	2	2	2	2	2	2	2	2	2				2	2	0	0	0	0	0	2											
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)	3																				0	0	3												
7.0	Room RH Sensors	0																					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 :		6	0	2	2	2	2	2	2	4	7	6	2	0	0	0	0	2	2	0	0	0	1	1	0	7	0	0	0	0	2	0	0	0	0	
I/O Used:		50		12					8				17										13													
Total Spare:		24		6					6				6										6													
Total		74																																		

6 DUCTING MODIFICATION
 Scope of work includes dismantling of the existing class 100 AHU and use it to maintain the temperature of the CNNP grey area. Scope also includes installation of ducting in the grey area including fresh air ducting.

7 CIVIL WORKS
 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.

8 CLEAN ROOM VALIDATION
 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.

9 RECOMMENDED MAKES FOR HVAC

S.NO	DESCRIPTION	RECOMMENDED MAKES
1.	Air Handling units	CITIZEN / VTS / FLAKTWOODS / EDGETECH / SYSTEMAIR/ZECO/ HEMAIR/ i-Clean
2	Motors for AHU	CROMPTON/GREAVES/ABB/SIEMENS/SCHNIDER
3	Starter	Siemens/ABB/L&T/SCHNEIDER
4	Fire Dampers	Air Master/Caryaire/Ajanta/System Air/Cosmos
5	Pan type humidifier	RAPID COOL/NORDAMANN/Walter Meier/Appidi
6	Ducting – GI Sheets	SAIL/TATA/Jindal
7	Duct Insulation	ARMAFLEX/K FLEX/SUPREME/AEROFLEX/TROCELLENE
8	Butterfly and Ball valves	Castle/Advance/Audco/Alfa Laval/L&T/Sant
9	3 Way /2 way Mixing Valve	Honeywell/Siemens/Johnson/Belimo/

	10	Balancing Valve	L&T/Advance/Bell & Gossett/Tour & Anderson
	11	Y- Strainer	Sant /DS Engg/Lehry
	12	Pumps	Johnson/ Grundfos /Armstrong
	13	Pipe SS	TATA/Ratanamani/Jindal
	14	Pressure and Temperature gauges	WIKA/FORBE MARSHALL/HGURU/WAREE
10	Additional Specifications		
	1) Clean Room should accommodate equipment operational heat load of 20 kW		
	2) Clean room Exhaust should be 6134 CFM		
	3) Clean room should accommodate atleast 15 members after upgradation.		

BILL OF QUANTITIES- CLEAN ROOM HVAC UPGRADATION WORK

S.NO	DESCRIPTION
1	<p>AHU-1 for Class 1000 clean room – 1 No</p> <p>Design, supply, installation, Testing and commissioning of AHU of modular construction, double walled with 45+2 mm thick PUF insulation , 0.8 mm thick percolated GSS outer skin and 0.8 mm thick plain GSS sheet inside. Draw through type comprising of fan section, coil section, pre filter, fine filter & HEPA filter section, fabricated from Extruded Al sections, joined together to provide a sturdy, strong and self supporting frame work for various sections, air capacity of 8647 CFM, total static pressure of 150mm WC, direct driven, single stage plug type centrifugal fans with Al alloy blades, with high efficiency (IE3) VFD compatible motors, fan placed on Extruded aluminium sections and on vibration isolators to reduce amplitude to less than 25-50 microns, copper cooling coils of 25 SWG with sufficient area for limiting the air velocity to 2.25 m/s through coil, pre filter (G4), fine filters (F7), HEPA filter sections with sufficient area to reduce the velocity to 2.25m/s, sound attenuator at suction and discharge of the unit to reduce the noise level to 70+ 2 dB(A).</p>
2	<p>AHU 2 for Class 100 clean room: - 1 No</p> <p>Design, supply, installation, Testing and commissioning of AHU of modular construction, double walled with 45+2 mm thick PUF insulation , 0.8 mm thick percolated GSS outer skin and 0.8 mm thick plain GSS sheet inside. Draw through type comprising of fan section, coil section, pre filter, fine filter & HEPA filter section, fabricated from Extruded Al sections, joined together to provide a sturdy, strong and self supporting frame work for various sections, air capacity of 5076 CFM, total static pressure of 150mm WC, direct driven, single stage plug type centrifugal fans with Al alloy blades, with high efficiency (IE3) VFD compatible motors, fan placed on Extruded aluminium sections and on vibration isolators to reduce amplitude to less than 25-50 microns, copper cooling coils of 25 SWG with sufficient area for limiting the air velocity to 2.25 m/s through coil, pre filter (G4), fine filters (F7), HEPA filter sections with sufficient area to reduce the velocity to 2.25m/s, sound attenuator at suction and discharge of the unit to reduce the noise level to 70+ 2 dB(A).</p>
3	<p>Pumps: - 2 Nos</p> <p>Horizontal inline centrifugal pump, capacity: 550LPM@3 kg/cm², with factory fitted mechanical seal, bronze impeller, EN8/SS shaft, high efficiency motor (IE3), complete with all the accessories like base frame, coupling, interface fasteners, matching flanges etc.</p>
4	<p>Chilled water piping for both AHU – 1 Lot</p> <p>a) SS304 SCH 10 Seamless pipe including all the fittings like bends, flange, etc.</p> <p>b) Butterfly valve, PN16/class 150 rated with CI/SG body and SS disc.</p> <p>c) Ball valve, PN17/class 150 with SS body.</p> <p>d) Stainer with SS body with SS wire mesh and PN16 rated.</p> <p>e) check valves, heavy duty (rating PN-16/Class 150), dual plate, zero leakage type, casing & all the internal parts of SS 304.</p> <p>f) 3 way Modulating valve.</p> <p>g) Drain & vent line connection with isolation valve.</p>

5	Temperature sensors cum transmitters with all fittings and SS316 thermowell, etc. – 4 Nos
6	Differential pressure sensors across filters – 6 Nos
7	Pressure gauges complete with all the fittings and isolating valves etc. – 6 Nos
8	Temperature and RH sensor - Accuracy: Temp. +/- 0.2 Deg C, RH +/-1 % - 4 Nos
9	Duct Air flow sensor – 2 Nos
10	Chilled water Piping Insulation: - 1 Lot 50mm thick puff insulation, 40±2 Kg/m ³ Density, classed with Aluminium sheet of 26G.
11	Ducting: - 250 Sqm Supply, installation, testing & commissioning of pre- fabricated GI sheet metal ducting (Prefabricating Ducting means duct fabrication on CNC machines) complete with GI / MS supports (complete supporting structure to install ducts at site) with fully threaded GI rods, GI nuts and bolts (With check nuts wherever applicable), vanes, splitters, thermal isolation blocks, etc. as per drawings and SMACNA standards for 4 inch and 2 inch pressure class. Ducting will have ductmate flanges with Food Grade Rubber Gasket between the flanges. All duct supports shall have minimum 3 mm thk. insulated tape between support and duct. All Ducting seam to be sealed with RTV Sealant. The zinc coating thickness should not be less than 120 grams/sq.mtr (GSM).All duct joints shall be inspected for leakage.MS duly painted supporting will be installed at standard distances.
12	Duct Insulation: - 350 Sqm Supply, installation of 19 mm thick nitrile rubber insulation with one side Aluminum faced. The Insulation Material shall be FM Approved. The insulation shall 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 clad 0.5 mm thick.
13	Fire Dampers for AHU 1 & AHU 2 – 4 Nos
14	Exhaust blower: - 1 No Capacity at least 2000 CFM, static pressure of 200 MM WC with exhaust stack & flow detector.
15	PP+ FRP ducting 350mm dia – 36 Mtrs
16	HMI control panel for monitoring temp and RH of all rooms. – 1 Lot AHU supply air volume to be varied based on the room exhaust flow rates. HMI panel to be positioned at clean room or control room to monitor all the parameters
17	Electrical DB: - 1 Lot Supply, Installation, testing and commissioning of wall mounted type DB with by pass arrangement DOL/SD type electrical control panel and provision microprocessor controller with display for Temperature, RH controlling, monitoring with status of AHU. Interlocking with strip heater system. Interlocking b/w AHU & Exhaust blower. Provision for: 1) AHU- VFD drive 2) Exhaust blowers- VFD drive 3) SCR controls for 3 heaters
18	Electrical cabling with Metal trunking. – 1 Lot
19	Modification works – 1 Lot a) Dismantling existing GI fresh air ducting b) Dismantling existing wet bench exhaust duct for 2 wet benches. c) Dismantling existing Fresh air handling unit. d) Blank off existing holes made for fresh air at the clean room ceiling panels. e) Connecting Existing class 100 AHU to CNNP grey area with suitable ducting and fresh air provision.
20	Civil works – 1 Lot Civil works for duct entry, finishing works after installation of duct with painting.
21	Testing & Commissioning of HVAC system – 1 Lot
22	Clean room validation – 1 Lot

TECHNICAL BID PROFORMA

Tender No. EE/AMIT/043/2022/CLEANROOMHVAC

Item Name: CLEAN ROOM HVAC UPGRADATION WORK

1.0 Bidder Eligibility Criteria:

I	Bidder Eligibility Criteria-I (Public Procurement – Preference to Make in India)	Class I / Class II	Local Content value	Reference, Page No.
I	Only 'Class-I local suppliers' and 'Class-II local suppliers', as defined under DIPP, MoCI Order No. P-45021/2/2017-PP (BE II) dated 16 th September 2020 and other subsequent orders issued therein.			
2.0	Bidder Eligibility Criteria-II	Compliance (Yes/No)	Reference Page No.	Remarks, If any
1	The bidder should have executed minimum 5 similar nature of projects i.e., Class-100 or Class-1000 Semiconductor Clean rooms at IITs, NITs, IISERs, CSIR Labs or other Govt. R&D organizations in the last 10 years, and Relevant PO/Installation certificates for the similar type of work executed should be provided.			
2	Bidder should be ISO and CE certified.			

3.0 Technical Compliance:

Centre for NEMS and Nanophotonics (CNNP) was established in the year 2011 – A part of Microelectronics & MEMS laboratory which is a semiconductor fabrication lab in the Electrical Engineering Department. Many sophisticated Chip Fabrication and Characterization tools are housed inside. We are planning to install some Additional equipment's inside the same clean room. Since, the capacity of existing clean room HVAC system is not sufficient to handle the additional load, it is proposed to upgrade the existing HVAC system. The upgraded HVAC system should maintain below condition inside both the clean rooms.

- a) Temperature: $22 \pm 1^\circ\text{C}$
- b) Relative Humidity: $45 \pm 5\%$

IITMadras will provide the Chilled water at $8 \pm 1^\circ\text{C}$ and flow rate of 700 LPM with 3 bar pressure.

The schematic for the HVAC upgradation facility is attached in the Annexure-1. The detail scope of work is as follows,

- 1) Design, Supply & installation of 2 Nos. of Air Handling Unit (AHU), for Class1000 and Class 100 clean rooms.
- 2) Supply & installation of interfacing Pipe line including fittings, valve, etc for AHU's.
- 3) Supply & installation of Ducting from AHU's to clean room as per requirements including any modification if required for existing ducting.

- 4) Disconnecting of existing Class 100 clean room AHU and connect to the CNNP grey area with suitable ducting and fresh air provision from atmosphere.
- 5) Supply & installation of Exhaust blower for wet benches including PP-FRP ducting.
- 6) Supply & installation of Electrical & instrumentation controls for the facility.
- 7) Validation of class 100 & class 1000 clean room after commissioning of HVAC upgradation work.

S.NO	SPECIFICATION	COMPLIED / NOT COMPLIED	CATALOGUE PAGE NO
1.	<p><u>AIR HANDLING UNIT (AHU) (Quantity- 2No)</u></p> <p>Scope of work included design, supply, installation and commissioning of 1 Nos. 8647 CFM capacity Air handling unit for class 1000 clean room facility and 1 Nos. 5076 CFM capacity AHU for class 100 clean room facility.</p> <p>A) Specification of the Air Handling Unit (AHU) for class 1000 clean room is given below:</p> <ol style="list-style-type: none"> a. Total Supply air = 4.081 M3/sec b. Return air =1.478 m3/sec c. Fresh air =2.603 m3/sec d. Total fan Static =150mm WG e. Cooling Coil Capacity =53 Tr. f. Heater capacity= 57 kW g. Humidification Duty =2.9 Kg/hr <p>B) Specification of the Air Handling Unit (AHU) for class 100 clean room is given below:</p> <ol style="list-style-type: none"> a. Total Supply air = 2.396 M3/sec b. Return air =1.736 m3/sec c. Fresh air =0.66 m3/sec d. Total fan Static =150 mm WG e. Cooling Coil Capacity =19 Tr. f. Heater Capacity= 33 kW g. Humidification duty:1.25 Kg/Hr 		
1.1	<p>AHU CASING</p> <ol style="list-style-type: none"> 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. 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. 3) The framework for each section shall be joined together with soft rubber gasket in between to make joints air tight. 4) Suitable air tight access doors with Aluminium die cast heavy duty hinges and locks shall be provided for various sections. 5) The casing shall incorporate thermal break profile and all other necessary design 		

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

	airstat in redundant arrangement along with all control devices which will be controlled by thyristors		
1.5	<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 the 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 condition to be considered.</p>		
1.6	<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. • 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 600mm x 600mm (preferably). <p>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.</p> <p>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.</p> <p>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 < 15 mm of WG.</p> <p>Accessories Requirement: Frame, supports, sealing gasket (Neoprene gasket pasted on the back side of the flange), quick release mechanism.</p>		
1.7	<p>CHILLED WATER PIPING</p> <p>1) The line shall be of SS 304 SCH 10 pipes.</p> <p>2) Booster pumps with one working and one stand-by arrangement (for each AHU) shall be provided in the chilled water line.</p> <p>3) The line shall be complete with all the fittings like valves, flanges, bends etc.</p> <p>4) The flanges shall be SS heavy duty (rating PN 16).</p> <p>5) The gaskets shall be good quality neoprene of appropriate thickness.</p> <p>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.</p> <p>7) The temperature gauges of suitable range shall be 4 inches dial type. The sensor, capillary and thermo-well shall be SS316.</p> <p>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.</p> <p>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.</p> <p>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</p>		

	<p>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.</p> <p>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.</p>		
1.7.1	<p>BUTTERFLY VALVE</p> <ol style="list-style-type: none"> 1) The butterfly valve should be CI/SG body with EPDM liner and SS316 disc preferably in two piece Construction. 2) The disc should consist of disc pivot and driving stem shall be in one piece centrally located. 3) The valve seat should be synthetic material suitable for water duty. It shall line the whole body. 4) The disc should move in slide bearings on both ends with 'o' ring to prevent leakage. 5) The handle should have arrangement for locking in any set position. 6) All valves 200mm Dia. and above should be gear operated. 7) The valve should be suitable for 16 Kg/cm² working pressure. 		
1.7.2	<p>BALL VALVE</p> <ol style="list-style-type: none"> 1) All Valves 40 mm Dia. and below should be of SS304 single piece type PN 16 rated. 2) Ball type Valves with (FPT) female threads conforming to class 2 of IS 778 and mating flanges fitting. 3) All Ball valves should be ISI Marked. 		
1.7.3	<p>3 WAY MODULATING VALVE</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>		
1.7.4	<p>DUAL PLATE CHECK VALVE</p> <ol style="list-style-type: none"> 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. 		
1.7.5	<p>STAINERS</p> <ol style="list-style-type: none"> 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. 		
1.7.6	<p>JOINING</p> <ol style="list-style-type: none"> 1) 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.		
1.7.7	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.		
1.7.8	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.		
1.8	CHILLED WATER PUMPS 1) Quantity – 2 Nos.(1 W+ 1S) 2) Pump flow rate: 550LPM @ 3 Kg/cm ² 3) Pump type: Horizontal centrifugal pumps. 4) Heavy duty for continuous operation 5) MOC: 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.		
1.9	INSTRUMENTATION & CONTROL 1) Three-way flow control valve, complete with all the accessories and with a manual bypass line with an isolation valve. 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. 3) Cooling coil water inlet and outlet temperature sensor cum transmitter. 4) Pressure gauges with isolation ball valves at inlet and outlet of the coils. Temperature gauges with thermowells.		

	<p>5) Pressure gauges with isolation ball valves at inlet and outlet of all the pumps 6) Differential pressure sensor across pre filters and fine filters. 7) VFDs for AHU fans. 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.</p>		
<p>2</p>	<p>DUCTING</p> <p>Ducts shall comprise of factory fabricated uninsulated GI sheet metal ducting with zinc deposition of 120 gm/m² 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> <ul style="list-style-type: none"> a) 18 G (1.27 mm thick) suitable for > 50 inch diagonal ducts b) 20 G (0.95 mm thick) for > 40 inch ducts c) 22 G (0.8 mm thick) for > 30 inch ducts d) 24 G (0.64 mm thick) for > 20 inch ducts <p>Construction Features (applicable only for factory fabricated ducts):</p> <ul style="list-style-type: none"> 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. 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. 3) To avoid leakage silicone sealant shall be used and leakage from duct joints shall be minimum (3 to 5%). 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). 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(whenever 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. 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. 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. 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. 		

2.1	<p>INSULATION</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 clad 0.5 mm thick for protection against rain and other extreme atmospheric conditions.</p>		
3	<p>FIRE DAMPERS</p> <ol style="list-style-type: none"> 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. 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. 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. 		
4	<p>ELECTRICAL</p> <ol style="list-style-type: none"> 1) General Design Consideration <ol style="list-style-type: none"> a) System configuration <ol style="list-style-type: none"> 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 <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> 2) Cabling for electrical supply from wall mounted electrical panel to respective AHUs/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 SCR 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 : <ol style="list-style-type: none"> a) AHU(Heaters, Blower, Humidifier) 		

- b) Pumps.
- 10) AHU panel Interlocks
 - a. Flow Switch- 1nos
 - b. AHU Door interlock- 1 nos
 - c. Smoke and Fire- 1nos
 - d. Thermal Interlock- 1nos
 - e. Access control Emergency interlock- 1nos.

5 BMS
 Dedicated HVAC BMS system with HMI panel shall be with the following I/O's

		M & E SYSTEM EQUIPMENT																																				
S/N	System	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	PPM Fluoride	HF&Acid Alkaline level			
	CONTROL PANEL	0																																				
1.0	CHILLER	0	0																																			
2.0	CHILLER PUMP	2	2																																			
3.0	AHU	2	2			2	2	2	2	2	2	2	2	2	2																							
4.0	Exhaust Blower	1	1									1	1	1																								
5.0	Duct temp and RH Sensors room	2																																				
6.0	Air Flow sensor(AHU)	3																						1	1													
7.0	Room RH Sensors	0																																				
8.0	Fire alarm system	1																																				
9.0	Wet Scrubber(Blower)	1	1																																			
10.0	Dry Scrubber(Blower)	0	0																																			
	Sub Total :		6	0	2	2	2	2	2	2	4	7	6	2	0	0	0	2	2	0	0	0	1	1	0	1	1	0	7	0	0	0	2	0	0	0	0	
	I/O Used:	50	12							8			17															13										
	Total Spare:	24	6						6			6															6											
	Total	74																																				

6 DUCTING MODIFICATION
 Scope of work includes dismantling of the existing class 100 AHU and use it to maintain the temperature of the CNRP grey area. Scope also includes installation of ducting in the grey area including fresh air ducting.

7 CIVIL WORKS
 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.																																															
8	CLEAN ROOM VALIDATION 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.																																															
9	RECOMMENDED MAKES FOR HVAC																																															
	<table border="1"> <thead> <tr> <th>S.N O</th> <th>DESCRIPTION</th> <th>RECOMMENDED MAKES</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Air Handling units</td> <td>CITIZEN / VTS / FLAKTWOODS / EDGETECH / SYSTEMAIR/ZECO/ HEMAIR/ i-Clean</td> </tr> <tr> <td>2</td> <td>Motors for AHU</td> <td>CROMPTON/GREAVES/ABB/SIEMENS/SCHNIDER</td> </tr> <tr> <td>3</td> <td>Starter</td> <td>Siemens/ABB/L&T/SCHNEIDER</td> </tr> <tr> <td>4</td> <td>Fire Dampers</td> <td>Air Master/Caryaire/Ajanta/System Air/Cosmos</td> </tr> <tr> <td>5</td> <td>Pan type humidifier</td> <td>RAPID COOL/NORDAMANN/Walter Meier/Appidi</td> </tr> <tr> <td>6</td> <td>Ducting – GI Sheets</td> <td>SAIL/TATA/Jindal</td> </tr> <tr> <td>7</td> <td>Duct Insulation</td> <td>ARMAFLEX/K FLEX/SUPREME/AEROFLEX/TROCELLENE</td> </tr> <tr> <td>8</td> <td>Butterfly and Ball valves</td> <td>Castle/Advance/Audco/Alfa Laval/L&T/Sant</td> </tr> <tr> <td>9</td> <td>3 Way /2 way Mixing Valve</td> <td>Honeywell/Siemens/Johnson/Belimo/</td> </tr> <tr> <td>10</td> <td>Balancing Valve</td> <td>L&T/Advance/Bell & Gossett/Tour & Anderson</td> </tr> <tr> <td>11</td> <td>Y- Strainer</td> <td>Sant /DS Engg/Lehry</td> </tr> <tr> <td>12</td> <td>Pumps</td> <td>Johnson/ Grundfos /Armstrong</td> </tr> <tr> <td>13</td> <td>Pipe SS</td> <td>TATA/Ratanamani/Jindal</td> </tr> <tr> <td>14</td> <td>Pressure and Temperature gauges</td> <td>WIKA/FORBE MARSHALL/HGURU/WAREE</td> </tr> </tbody> </table>	S.N O	DESCRIPTION	RECOMMENDED MAKES	1.	Air Handling units	CITIZEN / VTS / FLAKTWOODS / EDGETECH / SYSTEMAIR/ZECO/ HEMAIR/ i-Clean	2	Motors for AHU	CROMPTON/GREAVES/ABB/SIEMENS/SCHNIDER	3	Starter	Siemens/ABB/L&T/SCHNEIDER	4	Fire Dampers	Air Master/Caryaire/Ajanta/System Air/Cosmos	5	Pan type humidifier	RAPID COOL/NORDAMANN/Walter Meier/Appidi	6	Ducting – GI Sheets	SAIL/TATA/Jindal	7	Duct Insulation	ARMAFLEX/K FLEX/SUPREME/AEROFLEX/TROCELLENE	8	Butterfly and Ball valves	Castle/Advance/Audco/Alfa Laval/L&T/Sant	9	3 Way /2 way Mixing Valve	Honeywell/Siemens/Johnson/Belimo/	10	Balancing Valve	L&T/Advance/Bell & Gossett/Tour & Anderson	11	Y- Strainer	Sant /DS Engg/Lehry	12	Pumps	Johnson/ Grundfos /Armstrong	13	Pipe SS	TATA/Ratanamani/Jindal	14	Pressure and Temperature gauges	WIKA/FORBE MARSHALL/HGURU/WAREE		
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12	Pumps	Johnson/ Grundfos /Armstrong																																														
13	Pipe SS	TATA/Ratanamani/Jindal																																														
14	Pressure and Temperature gauges	WIKA/FORBE MARSHALL/HGURU/WAREE																																														
10	Additional Specifications 1) Clean Room should accommodate equipment operational heat load of 20 kW 2) Clean room Exhaust should be 6134 CFM 3) Clean room should accommodate atleast 15 members after upgradation.																																															

BILL OF QUANTITIES- CLEAN ROOM HVAC UPGRADATION WORK

S.NO	DESCRIPTION	COMPLIED / NOT COMPLIED	CATALOGUE PAGE NO
1	<p>AHU-1 for Class 1000 clean room – 1 No</p> <p>Design, supply, installation, Testing and commissioning of AHU of modular construction, double walled with 45+2 mm thick PUF insulation , 0.8 mm thick percolated GSS outer skin and 0.8 mm thick plain GSS sheet inside. Draw through type comprising of fan section, coil section, pre filter, fine filter & HEPA filter section, fabricated from Extruded Al sections, joined together to provide a sturdy, strong and self supporting frame work for various sections, air capacity of 8647 CFM, total static pressure of 150mm WC, direct driven, single stage plug type centrifugal fans with Al alloy blades, with high efficiency (IE3) VFD compatible motors, fan placed on Extruded aluminium sections and on vibration isolators to reduce amplitude to less than 25-50 microns, copper cooling coils of 25 SWG with sufficient area for limiting the air velocity to 2.25 m/s through coil, pre filter (G4), fine filters (F7), HEPA filter sections with sufficient area to reduce the velocity to 2.25m/s, sound attenuator at suction and discharge of the unit to reduce the noise level to 70+ 2 dB(A).</p>		
2	<p>AHU 2 for Class 100 clean room: - 1 No</p> <p>Design, supply, installation, Testing and commissioning of AHU of modular construction, double walled with 45+2 mm thick PUF insulation , 0.8 mm thick percolated GSS outer skin and 0.8 mm thick plain GSS sheet inside. Draw through type comprising of fan section, coil section, pre filter, fine filter & HEPA filter section, fabricated from Extruded Al sections, joined together to provide a sturdy, strong and self supporting frame work for various sections, air capacity of 5076 CFM, total static pressure of 150mm WC, direct driven, single stage plug type centrifugal fans with Al alloy blades, with high efficiency (IE3) VFD compatible motors, fan placed on Extruded aluminium sections and on vibration isolators to reduce amplitude to less than 25-50 microns, copper cooling coils of 25 SWG with sufficient area for limiting the air velocity to 2.25 m/s through coil, pre filter (G4), fine filters (F7), HEPA filter sections with sufficient area to reduce the velocity to 2.25m/s, sound attenuator at suction and discharge of the unit to reduce the noise level to 70+ 2 dB(A).</p>		
3	<p>Pumps: - 2 Nos</p> <p>Horizontal inline centrifugal pump, capacity: 550LPM@3 kg/cm², with factory fitted mechanical seal, bronze impeller, EN8/SS shaft, high efficiency motor (IE3), complete with all the accessories like base frame, coupling, interface fasteners, matching flanges etc.</p>		
4	<p>Chilled water piping for both AHU – 1 Lot</p> <p>a) SS304 SCH 10 Seamless pipe including all the fittings like bends, flange, etc. b) Butterfly valve, PN16/class 150 rated with CI/SG body and SS disc. c) Ball valve, PN17/class 150 with SS body. d) Stainer with SS body with SS wire mesh and PN16 rated. e) check valves, heavy duty (rating PN-16/Class 150), dual plate, zero leakage type, casing & all the internal parts of SS 304. f) 3 way Modulating valve. g) Drain & vent line connection with isolation valve.</p>		
5	Temperature sensors cum transmitters with all fittings and SS316 thermowell, etc. – 4 Nos		
6	Differential pressure sensors across filters – 6 Nos		
7	Pressure gauges complete with all the fittings and isolating valves etc. – 6 Nos		
8	Temperature and RH sensor - Accuracy: Temp. +/- 0.2 Deg C, RH +/-1 % - 4 Nos		
9	Duct Air flow sensor – 2 Nos		
10	<p>Chilled water Piping Insulation: - 1 Lot</p> <p>50mm thick puff insulation, 40±2 Kg/m³ Density, classed with Aluminium sheet of 26G.</p>		
11	<p>Ducting: - 250 Sqm</p> <p>Supply, installation, testing & commissioning of pre- fabricated GI sheet metal ducting (Prefabricating Ducting means duct fabrication on CNC machines) complete with GI / MS</p>		

	supports (complete supporting structure to install ducts at site) with fully threaded GI rods, GI nuts and bolts (With check nuts wherever applicable), vanes, splitters, thermal isolation blocks, etc. as per drawings and SMACNA standards for 4 inch and 2 inch pressure class. Ducting will have ductmate flanges with Food Grade Rubber Gasket between the flanges. All duct supports shall have minimum 3 mm thk. insulated tape between support and duct. All Ducting seam to be sealed with RTV Sealant. The zinc coating thickness should not be less than 120 grams/sq.mtr (GSM).All duct joints shall be inspected for leakage.MS duly painted supporting will be installed at standard distances.		
12	Duct Insulation: - 350 Sqm Supply, installation of 19 mm thick nitrile rubber insulation with one side Aluminum faced. The Insulation Material shall be FM Approved. The insulation shallv 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.		
13	Fire Dampers for AHU 1 & AHU 2 – 4 Nos		
14	Exhaust blower: - 1 No Capacity at least 2000 CFM, static pressure of 200 MM WC with exhaust stack & flow detector.		
15	PP+ FRP ducting 350mm dia – 36 Mtrs		
16	HMI control panel for monitoring temp and RH of all rooms. – 1 Lot AHU supply air volume to be varied based on the room exhaust flow rates. HMI panel to be positioned at clean room or control room to monitor all the parameters		
17	Electrical DB: - 1 Lot Supply, Installation, testing and commissioning of wall mounted type DB with by pass arrangement DOL/SD type electrical control panel and provision microprocessor controller with display for Temperature, RH controlling, monitoring with status of AHU. Interlocking with strip heater system. Interlocking b/w AHU & Exhaust blower. Provision for: 1) AHU- VFD drive 2) Exhaust blowers- VFD drive 3) SCR controls for 3 heaters		
18	Electrical cabeling with Metal trunking. – 1 Lot		
19	Modification works – 1 Lot a) Dismantling existing GI fresh air ducting b) Dismantling existing wet bench exhaust duct for 2 wet benches. c) Dismantling existing Fresh air handling unit. d) Blank off existing holes made for fresh air at the clean room ceiling panels. e) Connecting Existing class 100 AHU to CNNP grey area with suitable ducting and fresh air provision.		
20	Civil works – 1 Lot Civil works for duct entry, finishing works after installation of duct with painting.		
21	Testing & Commissioning of HVAC system – 1 Lot		
22	Clean room validation – 1 Lot		

**SIGNATURE OF BIDDER ALONG WITH
SEAL OF THE COMPANY WITH DATE**

FINANCIAL BID (PROFORMA) - BILL OF QUANTITIES (BOQ)

Item Name: CLEAN ROOM HVAC UPGRADATION WORK
Tender No. EE/AMIT/043/2022/CLEANROOMHVAC

It. No	Description of work	Quantity	Units	Basic Rate in INR	GST in Percentage	Total Amount with taxes in INR
1	AHU-1 for Class 1000 clean room	1	No			
2	AHU 2 for Class 100 clean room	1	No			
3	Pumps	2	Nos			
4	Chilled water piping for both AHU	1	Lot			
5	Temperature sensors cum transmitters with all fittings and SS316 thermowell, etc.	4	Nos			
6	Differential pressure sensors across filters	6	Nos			
7	Pressure gauges complete with all the fittings and isolating valves etc.	6	Nos			
8	Temperature and RH sensor - Accuracy: Temp. +/- 0.2 Deg C, RH +/-1 %	4	Nos			
9	Duct Air flow sensor	2	Nos			
10	Chilled water Piping Insulation	1	Lot			
11	Ducting	250	Sqm			
12	Duct Insulation	350	Sqm			
13	Fire Dampers for AHU 1 & AHU 2	4	Nos			
14	Exhaust blower	1	No			
15	PP+ FRP ducting 350mm dia	36	Mtrs			

16	HMI control panel for monitoring temp and RH of all rooms	1	Lot			
17	Electrical DB	1	Lot			
18	Electrical cabling with Metal trunking	1	Lot			
19	Modification works	1	Lot			
20	Civil works	1	Lot			
21	Testing & Commissioning of HVAC system	1	Lot			
22	Clean room validation	1	Lot			
	Grand Total					

Total Amount Rupees in words _____



CENTRE FOR INDUSTRIAL CONSULTANCY & SPONSORED RESEARCH (IC&SR)
INDIAN INSTITUTE OF TECHNOLOGY MADRAS
CHENNAI 600 036



ELECTRONIC CLEARING SERVICE (Credit Clearing)/ REAL TIME GROSS SETTLEMENT (RTGS) FACILITY FOR RECEIVING PAYMENTS

A. Details of Account Holder

Name of the Institution	Indian Institute of Technology - Madras
Complete Contact Address	Industrial Consultancy and Sponsored Research Indian Institute of Technology-Madras, IIT- Madras Campus Post Office, Sardar Patel Road, Guindy, CHENNAI - 600 036
Telephone No./ Fax No.	Tel - 044-2257 8356
E- mail ID of the FO/AO/REG/DIR	dricsr@iitm.ac.in

B. Bank Account Details:

Institution Account Name (As per Bank Record)	The Registrar, Indian Institute of Technology - Madras
Account No.	2722101003872
Account Print Name	IIT F A/C , The Registrar IIT Madras
IFSC CODE	CNRB0002722
Bank Name (in full)	Canara Bank
Branch Name	IIT-Madras Branch
Complete Branch Address	Canara Bank, IIT-Madras Branch, IIT- Madras Campus Post Office, Sardar Patel Road, Guindy, CHENNAI - 600 036
MICR No.	600015085
Account Type	Savings Account

Certified that the Institute's account is in an RTGS enabled branch.

I hereby declare that the particulars given above are correct and complete.

Date:

Signature of the Competent Authority
of the Institution with seal.

FORMAT FOR AFFIDAVIT OF SELF-CERTIFICATION UNDER PREFERENCE TO MAKE IN INDIA – PER ITEM

Tender Reference Number:

Name of the item / Service:

Date: _____

I/We _____ S/o, D/o, W/o, _____

Resident of

Hereby solemnly affirm and declare as under:

That I will agree to abide by the terms and conditions of the Public Procurement (Preference to Make in India) Policy vide GoI Order no. P-45021/2/2017-PP (B.E.-II) dated 15.06.2017 (subsequently revised vide orders dated 28.05.2018, 29.05.2019 and 04.06.2020) MOCI order No. 45021/2/2017-PP (BE II) Dt.16th September 2020 & P- 45021/102/2019-BE-II-Part (1) (E-50310) Dt.4th March 2021 and any subsequent modifications/Amendments, if any and

That the local content for all inputs which constitute the said item/service/work has been verified by me and I am responsible for the correctness of the claims made therein.

Tick (✓) and Fill the Appropriate Category	
<input type="checkbox"/>	I/We _____ [name of the supplier] hereby confirm in respect of quoted items that Local Content is equal to or more than 50% and come under “ Class-I Local Supplier ” category.
<input type="checkbox"/>	I/We _____ [name of the supplier] hereby confirm in respect of quoted items that Local Content is equal to 20% but less than 50% and come under “ Class-II Local Supplier ” category.

- The details of the location (s) at which the local value addition is made and the proportionate value of local content in percentage

Address _____ Percentage of Local content: _____%

For and on behalf of (Name of firm/entity)

Authorized signatory (To be duly authorized by the Board of Directors)

<Insert Name, Designation and Contact No.>

[Note: In case of procurement for a value in excess of Rs. 10 Crores, the bidders shall provide this certificate from statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content.]

This letter should be on the letterhead of the quoting firm and should be signed by a competent authority. Non-submission of this will lead to Disqualification of bids.

(To be given on the letter head of the bidder)

No. _____

Dated: _____

CERTIFICATE

(Bidders from India)

I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India and hereby certify that I am not from such a country.

OR (*whichever is applicable*)

(Bidders from Country which shares a land border with India)

I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India and hereby certify that I from _____ (Name of Country) and has been registered with the Competent Authority. I also certify that I fulfil all the requirements in this regard and is eligible to be considered. *(Copy/ evidence of valid registration by the Competent Authority is to be attached)*

Place:

Date:

Signature of the Tenderer
Name & Address of the
Tenderer with Office Stamp