DOW UNIVERSITY OF HEALTH SCIENCES, KARACHI

BIDDING DOCUMENTS

Single Stage – Two Envelope Procedure

As per Rule 46 (2) of SPPR, 2010 (Amended upto date)

IFB / NIT No. DUHS/P&D/2022/11300, Dated: 26 December, 2022

SUPPLY / FIXING / INSTALLATION / TESTING & COMMISSIONING OF HVAC SYSTEM AT PLASMA COLLECTION & PROCESSING FACILITY FOR BBMF DIABAR AT OJHA CAMPUS, DUHS, KARACHI (Ref No: DUHS/W&S-NIT/105)

OFFICE OF THE DIRECTOR PLANNING & DEVELOPMENT
DOW UNIVERSITY OF HEALTH SCIENCES,
BABA-E-URDU ROAD, BESIDES CIVIL HOSPITAL, KARACHI

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A: INSTRUCTIONS TO BIDDERS. (ITB)

1. INTRODUCTION

1. GENERAL

1.1 Dow University of Health Sciences, Karachi intends to **SUPPLY / FIXING / INSTALLATION / TESTING/ COMMISSIONING OF HVAC SYSTEM AT PLASMA COLLECTION & PROCESSING FACILITY FOR BBMF DIABAR AT OJHA CAMPUS, DUHS, KARACHI.**

2. ELIGIBLE BIDDERS

2.1 This Invitation for Bids is open to all original Manufacturers, within Pakistan and abroad, and their Authorized Agents / Importers / Bidders / Distributors..

2.2 Bidders should not be associated, or have been associated in the past, directly or indirectly, with a firm or any of its affiliates which have been engaged by the University to provide consulting services for the preparation of the design, specifications, and other documents to be used for the procurement of the goods to be purchased under this Invitation for Bids.

2.3 Joint Venture (JV) shall not be allowed,

2.4 Government-owned enterprises may participate only if they are legally and financially autonomous, if they operate under commercial law, and if they are not a dependent agency of the Federal Govt. or Provincial Govt.

2.5 Bidder should not be eligible to bid if they are under a declaration of ineligibility for corrupt and fraudulent practices issued by any Government organization in accordance with sub **clause 34.1.**

3. ELIGIBLE GOODS

3.1 All goods and related services to be supplied under the contract shall have their origin in eligible source countries and all expenditures made under the contract shall be limited to such goods and services. For this purpose, the term "Goods" ' includes any Goods that are the subject of this Invitation for Bids and the term "Services" shall include related services such as transportation, insurance etc. **THE "ORIGIN" MEANS THE PLACE WHERE THE "GOODS" ARE MINED, GROWN, OR PRODUCED, OR THE PLACE FROM WHICH THE "RELATED SERVICES" ARE SUPPLIED**. Goods are produced through manufacturing or processing, or substantial and major assembly of ingredients / components, a commercially recognized product results that is substantially different in basic characteristics or in purpose or utility from its components.

2. THE BIDDING PROCEDURE

4. SINGLE STAGE - TWO ENVELOPE PROCEDURE

4.1 Bid shall comprise a single package containing two separate envelopes. Each envelope shall contain separately the financial proposal and the technical proposal;

4.2 Envelopes shall be marked as **"FINANCIAL PROPOSAL"** and **"TECHNICAL PROPOSAL"** in bold and legible letters to avoid confusion; including 2 copies of each,

4.3 Initially, only the envelope marked **"TECHNICAL PROPOSAL"** shall be opened;

4.4 Envelope marked as **"FINANCIAL PROPOSAL"** shall be retained in the custody of the procuring agency without being opened;

4.5 Procuring agency shall evaluate the technical proposal in a manner prescribed in advance, without reference to the price and reject any proposal which does not conform to the specified requirements;

4.6 No amendments in the technical proposal shall be permitted during the technical evaluation;

4.7 Financial proposals of technically qualified bids shall be opened publicly at a time, date and venue announced and communicated to the bidders in advance;

4.8 Financial proposal of bids found technically non-responsive shall be returned un-opened to the respective bidders; and

4.9 Most advantageous bid shall be accepted.

The bids shall be opened in the presence of bidders or their authorized representative at the prescribed time, date and venue.

3. THE BIDDING DOCUMENTS

5. CONTENTS OF BIDDING DOCUMENTS

5.1 The Bidding Documents:

In addition to the Invitation for Bids (IFB) / Tender Notice, the bidding documents include:

i. Instructions to Bidders (ITB);
ii. General Conditions of Contract (GCC);
iii. Special Conditions of Contract (SCC);
iv. Schedule of Requirements;
v. Technical Specifications;
vi. Contract Form;
vii. Manufacturer's Authorization Form;
viii. Performance Guarantee Form;
ix. Bid Form; and
x. Price Schedules.

5.2 In case of discrepancies between the Invitation for Bids (IFB) / Tender Notice and the Bidding Documents, the Bidding Documents shall take precedence.

5.3 The bidders are expected to examine all instructions, forms, terms, and specifications in the bidding documents. Failure to furnish complete information required in the bidding documents or to submit a bid not substantially responsive to the bidding documents may result in rejection.

6. AMENDMENT / CLARIFICATION OF BIDDING DOCUMENTS

6.1 An interested bidder, who has obtained bidding documents, may request for clarification of contents of the bidding document in accordance with the Rule 23(1) of SPPRA Rules, 2010 (Amended upto date).

6.2 At any time prior to the deadline for submission of bids, the Procuring Agency may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Bidder, modify the bidding documents by amendment.

6.3 All prospective bidders that have received the bidding documents will be notified the amendment(s) in writing, which will be binding on them.

6.4 In order to allow prospective bidders reasonable time to take the amendment(s) into account in preparing their bids, the Procuring Agency may, at its discretion, extend the deadline for submission of the bids.

4. PREPARATION OF BIDS

7. LANGUAGE OF BID

7.1 Preparation of Bids

The bid prepared by the bidder, as well as all correspondence and documents relating to the bid exchanged by the bidder and the Procuring Agency shall be in English. Supporting documents and printed literature furnished by the bidder may be in another language provided these are accompanied by an accurate translation of the relevant passages in English, in which case for purposes of interpretation of the Bid, the translated version shall prevail.

8. DOCUMENTS COMPRISING THE BID

8.1 The bid prepared by the Bidder shall comprise the following:

(a) Bid Form;
(b) Price Schedule;
(c) Documentary evidence to the effect that the Bidder is eligible to bid and is qualified to perform the Contract if its bid is accepted;
(d) Documentary evidence to the effect that the goods to be supplied by the Bidder are eligible goods and related services as defined in clause-3 and conform to the bidding documents; and
(e) Bid Security.

9. BID PRICES

9.1 The prices and discounts quoted by the Bidder in the Bid Form and in the Price Schedules shall conform to the requirements specified below.

9.2 All items in the Schedule of Supply must be listed and priced separately in the Price Schedules. If a Price Schedule shows items listed but not priced, their prices shall be assumed to be included in the prices of other items. Items not listed in the Price Schedule shall be assumed not to be included in the Bid.

9.3 The price to be quoted in the Bid Form shall be the total price of the Bid excluding any discounts offered.

9.4 The Bidder shall quote any unconditional discounts and the methodology for their application in the Bid Form.

9.5 Prices proposed in the Price Schedule Forms for Goods, shall be disaggregated, when appropriate. This disaggregation shall be solely for the purpose of facilitating the comparison of Bids by the Procuring Agency. This shall not in any way limit the Procuring Agency's right to contract on any of the terms offered:

(a) Price Schedule For Goods offered from within the Procuring Agency's country:

(i) Detailed Specification of Stores

(ii) Model / Cat No.

(iii) Name of Manufacturer.

(iv) Country of Origin

(v) Quantity of Stores

(vi) Unit

(vii) the unit price of the goods quoted on delivered duty paid (DDP) basis, including all customs duties and sales and other taxes already paid or payable on the components and raw material used in the manufacture or assembly of goods, or on the previously imported goods of foreign origin;

(viii) If there is no mention of taxes, the offered/quoted price will be considered as inclusive of all prevailing taxes/duties. The benefit of exemption from or reduction in the GST or other taxes during the contract period shall be passed on to the Procuring Agency; and

(ix) the total price for the item.

9.6 Final Prices quoted by the Bidder shall be fixed during the Bidder's performance of the Contract and not subject to variation on any account. A Bid submitted with an adjustable price quotation shall be treated as nonresponsive and shall be rejected.

9.7 If it was proved during the contract period that bidder has supplied the contracted item(s) to any other purchasing agency in Pakistan at the prices lower then the contracted prices, the balance amount will be deducted from the bill and / or security deposit of the bidder.

10. BID CURRENCIES

10.1 Prices shall be quoted in Pakistani Rupees for goods offered within the Procuring Agency's country on delivered duty paid (DDP).

11. DOCUMENTS ESTABLISHING BIDDER'S ELIGIBILITYAND QUALIFICATION

11.1 The documentary evidence of the Bidder's qualifications to perform the contract if its bid is accepted shall establish to the Procuring Agency's satisfaction:

(a) that, in the case of a Bidder offering to supply goods under the contract which the Bidder did not manufacture or otherwise produce, the Bidder has been duly authorized by the goods' Manufacturer or producer to supply the goods in the Procuring Agency's country;

(b) That the Bidder has the financial, technical, and production capability necessary to perform the contract;

(c) that, in the case of a Bidder not doing business within the Procuring Agency's country, the Bidder is or will be (if awarded the contract) represented by an Agent in that country equipped, and able to carry out the Bidder's maintenance, repair, and spare parts-stocking obligations prescribed in the Conditions of Contract and/or Technical Specifications; and

(d) That the Bidder meets the evaluation & qualification criteria of bidding document.

12. DOCUMENTS ESTABLISHING GOODS' ELIGIBILITY AND CONFORMITYTO BIDDING DOCUMENTS

12.1 Pursuant to ITB Clause 8, the Bidder shall furnish, as part of its bid, documents establishing the eligibility and conformity to the bidding documents of all goods and services which the Bidder proposes to supply under the contract.

12.2 The documentary evidence of the eligibility of the goods and services shall consist of a statement in the Price Schedule of the country of origin of the goods and services offered which shall be confirmed by a certificate of origin issued at the time of shipment.

12.3 The documentary evidence of conformity of the goods and services to the bidding documents may be in the form of literature, drawings, and data, and shall consist of:

(a) a detailed description of the essential technical and performance characteristics of the goods; and

(b) an item-by-item commentary on the Procuring Agency's Technical Specifications demonstrating substantial responsiveness of the goods and services to those specifications, or a statement of deviations and exceptions to the provisions of the Technical Specifications.

12.4 For purposes of the commentary to be furnished pursuant to ITB Clause 12.3(b) above, the Bidder shall note that standards for workmanship, material, and equipment, as well as references to brand names or catalogue numbers designated by the Procuring Agency in its Technical Specifications, are intended to be descriptive only and not restrictive. The Bidder may substitute alternative standards, brand names, and/or catalogue numbers in its bid, provided that it demonstrates to the Procuring Agency's satisfaction that the substitutions ensure substantial equivalence to those designated in the Technical Specifications.

13. BID SECURITY

13.1 The Bidder shall furnish, as part of its proposal, a Bid Security in the amount and currency specified in the Bid Data Sheet and SCC. Unsuccessful bidders' Bid Security will be returned soon after approval of the successful Bidder. The successful Bidder's Bid Security will be discharged upon signing of contract and furnishing the Performance Security bond, duly guaranteed by a scheduled bank.

13.2 The Bid Security shall remain valid for a period of 28 days beyond the bid validity period.

13.3 The Bid Security is required to protect the Procuring Agency against the risk of Bidder's conduct, which would warrant the Security's forfeiture;

13.4 The Bid Security may be forfeited:

(a) if a Bidder withdraws its bid during the period of bid validity; or

(b) in the case of a successful Bidder, the Bidder fails:

(i) to sign the Contract; or

(ii) to complete the supplies in accordance with the General Conditions of Contract.

14. BID VALIDITY

14.1 Bids shall remain valid for 90 days from the date of its opening. A bid valid for a shorter period shall be treated as non-responsive and rejected.

14.2 The Procuring Agency shall ordinarily be under an obligation to process and evaluate the bids within the stipulated bid validity period. However, for any reasons to be recorded in writing, if an extension is considered necessary, all those who have submitted their bids shall be asked to extend their respective bid validity period.

15. ALTERNATIVE BIDS

15.1 Unless otherwise indicated in the Bid Data Sheet, alternative bids shall not be considered.

5. SUBMISSION OF BIDS

16. SEALING AND MARKING OF BIDS

16.1 The envelopes shall:

(a) bear the name and address of the Bidder;

(b) bear the specific identification Name and Number of this bidding process indicated in the Bid Data Sheet; and

(c) bear the Procuring Agency's name and address i.e. Dow University of Health Sciences, Administration Block, Baba-e-Urdu Road, Karachi and a statement: **"DO NOT OPEN BEFORE,"** the time and date specified in the Bid Data Sheet.

16.2 If all envelopes are not sealed and marked as required, the Procuring Agency will assume no responsibility for the misplacement or premature opening of the bid.

17. DEADLINE FOR SUBMISSION OF BIDS

17.1 Bids must be submitted by the bidders and received by the Procuring Agency at the specified address not later than the time and date specified in the Bid Data Sheet.

17.2 The Procuring Agency may, at its convenience, extend this deadline for submission of bids by amending the bidding documents in which case all rights and obligations of the Procuring Agency and the Bidders previously subject to the deadline will thereafter be subject to the deadline as extended.

18. LATE BID

18.1 Any bid received by the Procuring Agency after the deadline for submission of bids prescribed by the Procuring Agency shall not be entertained and returned unopened to the bidder.

19. WITHDRAWAL OF BIDS

19.1 The Bidder may after its submission withdraw prior to the expiry of the deadline prescribed for submission of bids.

6. OPENING AND EVALUATION OF BIDS

20. OPENING OF BIDS BY THE PROCURING AGENCY

20.1 The Procuring Agency will open all bids in the presence of bidders' representatives who choose to attend, at the time, on the date, and at the place specified in the Bid Data Sheet. The bidders' representatives who are present shall sign a register evidencing their attendance.

20.2 The bidders' names, bid modifications or withdrawals, bid prices, discounts, and the presence or absence of requisite bid security and such other details as the Procuring Agency, at its discretion, may consider appropriate, will be announced at the opening. No bid shall be rejected at bid opening, except for late bids, which shall be returned unopened to the Bidder pursuant to ITB Clause 18.

20.3 Bids (and modifications sent pursuant to ITB Clause 19) that are not opened and read out at bid opening shall not be considered further for evaluation, irrespective of the circumstances. Withdrawn bids will be returned unopened to the bidders.

21. CLARIFICATION OF BIDS

21.1 During evaluation of the bids, the Procuring Agency may, at its discretion, ask the Bidder for a clarification of its bid. The request for clarification and the response shall be in writing, and no change in the prices or substance of the bid shall be sought, offered, or permitted.

22. PRELIMINARY EXAMINATION

22.1 The Procuring Agency will examine the bids to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed, and whether the bids are generally in order.

22.2 Arithmetical errors will be rectified on the following basis. If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail, and the total price shall be corrected. If the Supplier does not accept the correction of the errors, its bid will be rejected, and its bid security may be forfeited. If there is a discrepancy between words and figures, the amount in words will prevail.

22.3 The Procuring Agency may waive any minor informality, nonconformity, or irregularity in a bid which does not constitute a material deviation, provided such waiver does not prejudice or affect the relative ranking of any Bidder.

22.4 Prior to the detailed evaluation, pursuant to ITB Clause 23 the Procuring Agency will determine the substantial responsiveness of each bid to the bidding documents. For purposes of these Clauses, a substantially responsive bid is one which conforms to all the terms and conditions of the bidding documents without material deviations. Deviations from, or objections or reservations to critical provisions, such as those concerning Bid Security, Applicable Law, and Taxes and Duties, will be deemed to be a material deviation. The Procuring Agency's determination of a bid's responsiveness is to be based on the contents of the bid itself without recourse to extrinsic evidence.

22.5 If a bid is not substantially responsive, it will be rejected by the Procuring Agency and may not subsequently be made responsive by the Bidder by correction of the nonconformity.

23. EVALUATION AND COMPARISON OF BIDS

23.1 The Procuring Agency will evaluate and compare the bids which have been determined to be substantially responsive, pursuant to ITB Clause 22.

23.2 The Procuring Agency's evaluation of a bid will be on delivered duty paid (DDP) inclusive of prevailing duties/taxes and will exclude any allowance for price adjustment during the period of execution of the contract, if provided in the bid.

23.3 The Procuring Agency's evaluation of a bid will take into account, in addition to the bid price quoted, one or more of the following factors, and quantified in ITB Clause 24:

(a) **Incidental Costs**
Incidental costs provided by the bidder will be added by Procuring Agency to the bid price at the final destination.

(b) **Delivery schedule offered in the bid**
The goods covered under this invitation are required to be delivered (shipped) within an acceptable range of weeks specified in the Schedule of Requirement.

(c) **Deviations in payment schedule from that specified in the Special Conditions of Contract**
Bidders shall state their bid price for the payment schedule outlined in the SCC. Bids will be evaluated on the basis of this base price. Bidders are, however, permitted to state an alternative payment schedule and indicate the reduction in bid price they wish to offer for such alternative payment schedule. The Procuring Agency may consider the alternative payment schedule offered by the selected Bidder.

(d) **Cost of components, mandatory spare parts, and service**
The Procuring Agency will estimate the cost of spare parts usage in the initial period of operation, based on information furnished by each Bidder, as well as on past experience of the Procuring Agency or other procuring agencies in similar situations. Such costs shall be added to the bid price for evaluation.

(e) **Availability of spare parts and after sales services for the equipment offered in the bid**
The cost to the Procuring Agency of establishing the minimum service facilities and parts inventories, as outlined in the Bid Data Sheet or elsewhere in the bidding documents, if quoted separately, shall be added to the bid price.

(f) **Projected operating and maintenance costs during the life of the equipment;**
Since the operating and maintenance costs of the goods under procurement form a major part of the life cycle cost of the equipment, these costs will be evaluated in accordance with the criteria specified in the Bid Data Sheet or in the Technical Specifications.

(g) **Performance and productivity of the equipment offered**
Bidders shall state the guaranteed performance or efficiency in response to the Technical Specification. For each drop in the performance or efficiency below the norm of 100, an adjustment for an amount will be added to the bid price, representing the capitalized cost of additional operating costs over the life of the plant, using the methodology specified in the Bid Data Sheet or in the Technical Specifications.

23.4 For the purpose of comparison of bids quoted in different currencies, price shall be converted into Pakistani Rupees. The rate of exchange shall be the selling rate prevailing seven working days before the date of opening of the bids, as notified by the National Bank of Pakistan (NBP) / State Bank of Pakistan (SBP).

24. EVALUATION / MANDATORY QUALIFICATION CRITERIA

24.1 Bids shall be evaluated on complete package basis. Bids for partial or limited items shall not be considered & rejected.

24.2 The following merit point system for weighing evaluation factors/criteria will be applied for technical proposals.

24.3 Bidders achieving minimum 70 marks will be considered only for further process. Documentary evidence must be attached in support of each parameter.

24.4 The Financial bid will be evaluated on the aggregated Amount in Pak Rupees. Conversion Rate should 7 (Seven) working days prior to open of bid date issue by NBP / SBP.

24.5 Any Bid not meeting the mandatory requirements of evaluation criteria will be disqualified / rejected straight away and will not be considered for further evaluation.

24.6 **At the opening time of Technical Bid, bring Original Sole distributor / Manufacturer authorization certificate/letter for verification. (Mandatory)**

24.7 Conformity to the Purchaser's Specification (Mandatory),

24.8 Bid Form and price schedule (B.O.Q) **(without prices)**,

24.9 Tender Purchase Receipt,

24.10 Taxation Certificate (NTN, GST & SST),

24.11 **Average Annual Turnover during the last three (03) years financial year should be above 50 Million (supported with Income Tax Returns & Audited statement)**

24.12 Pakistan Engineering Council P.E.C (ME-01) (Category C-4),

24.13 E-Inspector Certificate,

24.14 Item-wise product compliance / deviation statement,

24.15 Affidavit on Stamp Paper of Rs.100/- that:

(a) **Bidder is not involved in any litigation with the Public / Private Sector University / Government / Semi Government Organization (Provincial /Federal / Local).**

(b) **Bidder is not black listed by any Public / Private Sector University / Government / Semi Government Organization (Provincial/Federal / Local).**

A. PRODUCT EVALUATION

S#	PARAMETERS / SUB-PARAMETERS	Total Marks
1	**Conformity to the Purchaser's Specifications (MANDATORY)**	**25**
1.1	Fully compliant with the required specifications	25
1.2	Compliant with minor deviation (up to 10% subject to main function is not effected)	20
1.3	Non-compliant to required specifications	Disqualify
2	**Product Certification (MANDATORY)) with documentary proof**	**20**
2.1	Eurovent Certificate	05
2.2	AHRI / ARI Certificate	05
2.3	USA - Food and Drug Administration (USA-FDA) / Hygiene Certification	05
2.4	UL / FM (Fire Damper & Material	05
	TOTAL MARKS PRODUCT EVALUATION (A)	**45**

B. BIDDER EVALUATION

S#	PARAMETERS / SUB-PARAMETERS	Total Marks
3.	**Technical Staff with documentary proof evidences in the form of pay slips. Bank statements etc**	**10**
3.1	Diploma Engineers in relevant field duly trained by OEM for required equipment (2 mark for each)	4
3.2	Graduate Engineers in relevant field duly trained by OEM for required equipment (2 marks for each)	6
4.	**Networking and Training**	**6**
4.1	Networking setup across Pakistan (1 mark for each setup)	4
4.2	Certificate to affect that the firm will provide training in the use of equipment to the relevant technical staff. Training plan must be attached with certificate	2
5.	**Delivery Schedule at consignees end**	**4**
5.1	Up to 5 months or earlier	4
5.2	More than 6 months	0
6.	**Past Experience / Performance of Last 3 years**	**15**
6.1	Bidder's prior experience for supplying the **quoted or better equipment** to the Public / Private Sector Universities / Government / Semi-Government Organization (Provincial / Federal / Local) in Pakistan **during the last 3 years**. Documentary evidence in shape of Purchase Order, agreement and Installation Report / Satisfactory performance certificate must be attached. **(3 mark for supply of each equipment / instrument)**	15
7.	**Average Annual Turnover during the last three (03) years financial year (supported with Income Tax Returns)**	**15**
7.1	Turn over below 50 million	0
7.2	Turn over above 50 million	5
7.3	Turn over above 90 million	10
7.4	Turn over above 115 million	15
8.	**Bonus points**	**5**
8.1	Comprehensive extended Warranty period free of cost including parts, Labor, Services etc (at least one year)	5
	TOTAL BIDDER EVALUATION (B)	**55**
	GRAND TOTAL (A + B)	**100**

24.16 Only those item's Financial offer will be announced / considered which were technically qualify by the Committee. Bidders are advised to give separate sealed envelope (s) of every quoted item and should mention the name of the item and tender serial number on the front of the sealed envelope in **BOLD and legible letters** to avoid confusion, otherwise, the Financial Proposal Envelope will be opened on qualified item basis and it will not be challenged by the bidder that procuring agency has opened the Financial Proposal of the disqualified items besides qualified items.

24.17 Litigation History

The Bidder should not be involved in any litigation with the Public / Private Sector University / Government Organization (Provincial / Federal / Local), else their bid will be rejected.

25. CONTACTING THE PROCURING AGENCY

25.1 No bidder shall contact the Procuring Agency on any matter relating to its bid, from the time of the bid opening to the time the Contract is awarded. If any bidder wishes to bring additional information to the notice of the Procuring Agency, it may do so in writing.

25.2 Any direct or indirect effort by a bidding firm to influence the Procuring Agency during the process of selection of a bidder or award of contract may besides rejection of its bid result into its disqualification from participation in the Procuring Agency's future bids.

26. REJECTION OF BIDS

26.1 Not with standing anything stated here-before after the Procuring Agency may reject any or all bids at any time prior to the acceptance of a bid. The Procuring Agency may upon request, communicate to a bidder, the grounds for its rejection, but shall not be under obligation to justify those grounds.

27. RE-BIDDING

27.1 If the Procuring Agency has rejected all bids, it may move for a re-bidding or may seek any alternative method of procurement under the provisions of the prevailing Rules.

28. ANNOUNCEMENT OF EVALUATION REPORT

28.1 The Procuring Agency will announce the Evaluation Report and the resultant acceptance or rejection of bids at least seven days prior to the award of procurement contract.

7. AWARD OF CONTRACT

29. ACCEPTANCE OF BID AND AWARD CRITERIA

29.1 The bidder with lowest evaluated bid under clause 22, 23 & 24, if not in conflict with any other law, rules, regulations or policy of the Government, will be awarded the contract within the original or extended period of bid validity.

29.2

30. PROCURING AGENCY'S RIGHT TO VERY QUANTITIES

30.1 The Procuring Agency reserves the right to increase or decrease the quantity of stores originally specified in the Price Schedule and Schedule of Requirements without any change in unit price or other terms and conditions.

31. NOTIFICATION OF AWARD

31.1 Prior to the expiry of the original or extended period of bid validity, the successful bidder will be informed in writing of acceptance of its bid by the Procuring Agency.

32. SIGNING OF CONTRACT

32.1 While conveying acceptance of bid to the successful bidder, the Procuring Agency will send the bidder Contract Form provided in the bidding documents, incorporating all points of agreement between the Parties.

32.2 Ten days after the official announcement of the award, both the successful Bidder and the Procuring Agency will sign and date the Contract on legal stamp paper valuing 0.35% of the value of contract, (cost shall be borne by the bidder). In case the successful Bidder, after completion of all codal formalities, shows inability to sign the Contract, its Bid Security shall be forfeited. The firm may also be blacklisted from taking part in any future bidding of Procuring Agency for a period upto five Years. In such a situation, the Procuring Agency may make the award to the next lowest evaluated responsive bidder or move for re-bid.

33. PERFORMANCE SECURITY

33.1 The successful Bidder shall furnish Performance Security. Upon submission of Performance Security the Bid Security will be returned to the Bidder. The amount of Performance Security is specified at Bid Data Sheet.

33.2 Failure of the successful Bidder to comply with any of the requirements specified in this document shall be considered as sufficient grounds for the annulment of the award and forfeiture of the Bid Security, in which event the Procuring Agency may make the award to the next lowest evaluated Bidder at the risk and cost of the former.

34. CORRUPT OR FRAUDULENT PRACTICES

(a) The Procuring Agency and the Bidders / Manufacturers / Contractors are expected to observe the highest standard of ethics during the procurement and execution of the Contract. In pursuance of this policy, the relevant terms / phrases as may apply are defined below:

(b) "corrupt practice" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in Contract execution; and

(c) "fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a Contract to the detriment of the Procuring Agency, and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial noncompetitive levels and to deprive the Procuring Agency of the benefits of free and open competition;

(d) the Procuring Agency will take all possible administrative / legal measures if it is found that the Bidder recommended for award was / is engaged in corrupt or fraudulent practice(s) before or after signing of the contract resulting into the conviction of the proprietor under criminal case besides blacklisting of the firm either indefinitely or for such period of time as may be determined by the Procuring Agency.

(e) will declare a firm ineligible, either indefinitely or for a stated period of time, for the award of a Contract if it, at any time, determines that the firm has engaged in corrupt or fraudulent practices in competing for or in executing a Contract.

B: GENERAL CONDITIONS OF CONTRACT (GCC)

1. DEFINITIONS

1.1 In this Contract, the following terms shall be interpreted as indicated:

(a) "The Contract" means the agreement entered into between the Procuring Agency and the Bidder, as recorded in the Contract Form signed by the Parties, including all attachments and appendices thereto and all documents incorporated by reference therein.

(b) "The Contract Price" means the price payable to the Bidder under the Contract for the full and proper performance of its Contractual obligations.

(c) “Goods” means all of the commodities, raw material, machinery and equipment, and/or other materials that the Supplier is required to supply to the Procuring Agency under the Contract.

(d) “Related Services” means the services incidental to the supply of the goods, such as insurance, installation, training and initial maintenance, printing of special instructions on the label and packing, design and logo of the Procuring Agency, transportation of goods up to the desired destinations and other such obligations of the Bidder covered under the Contract.

(e) "GCC" means the General Conditions of Contract contained in this section.

(f) "SCC" means the Special Conditions of Contract.

(g) "The Procuring Agency" means the Dow University of Health Sciences, Karachi.

(h) "The Bidder" means the individual or firm supplying the goods under this Contract.

(i) "Day" means official working day excluding national holidays.

2. APPLICATION

2.1 These General Conditions shall apply to the extent that they are not inconsistent with provisions of other parts of the Contract.

3. STANDARDS

3.1 The goods supplied under this Contract shall conform to the standards mentioned in the Technical Specifications goods eligibility criteria.

4. USE OF CONTRACT DOCUMENTS AND INFORMATION

4.1 The Bidder shall not without the Procuring Agency's prior written consent, disclose the Contract, or any provision thereof, or any specification, plan, drawing, pattern; sample, or information furnished by or on behalf of the Procuring Agency in connection therewith, to any person other than a person employed by the Bidder in the performance of the Contract. Disclosure to such employed person shall be made in confidence and shall extend only, as far as may be' necessary, to such performance and not further or otherwise.

4.2 Any document, other than the Contract itself, shall remain the property of the Procuring Agency and shall be returned (all copies) on completion of the Bidder's performance under the Contract.

4.3 The Bidder shall permit the Procuring Agency to inspect the Bidder's accounts and records relating to the performance of the Supplies.

5. PATENT RIGHTS

5.1 The Bidder shall indemnify the Procuring Agency against all third-party claims of infringement of patent, trademark, or industrial design rights arising from use of the Goods or any part thereof in the country.

6. ENSURING STORAGE ARRANGEMENTS

6.1 To ensure storage arrangements for the intended supplies, the Bidder shall inform the Procuring Agency at least two weeks prior to the arrival of the consignments at its store/warehouse. However, in case no space is available at its store/warehouse at the time of supply, the Procuring Agency shall, seven days prior to such a situation, inform the Bidder, in writing, of the possible time-frame of availability of space by which the supplies could be made. In case the Bidder abides by the given time frame, he will not be penalized for delay.

7. INSPECTIONS, TESTS AND TRAINING

7.1 The Procuring Agency or its representative shall have the right to inspect and/or test the goods to confirm their conformity to the Contract specifications at the cost payable by the Bidder.

7.2 The Procuring Agency's right to inspect, test and, where necessary, reject the goods either at Bidder's premises or upon arrival at Procuring Agency's destinations shall in no way be limited or waived by reasons of the goods having previously been inspected, tested, and approved by the Procuring Agency or its representative prior to the goods shipment from the manufacturing point.

7.3 Any specialized training required for the smooth operation of the goods shall be the responsibility of the Bidder.

8. DELIVERY AND DOCUMENTS

8.1 The Bidder shall in accordance with the terms specified in the Schedule of Requirements make delivery of the goods. Details of documents to be furnished by the Bidder are specified in SCC.

9. INSURANCE

9.1 The goods supplied under the Contract shall be delivered to the Procuring Agency after the payment of all taxes and customs duty, cess, octroi charges etc. Risk will be transferred to the Procuring Agency only after the delivery of these goods has been made to the Procuring Agency. Hence, payment of insurance premium, if any, shall be the responsibility of the Bidder.

10. TRANSPORTATION

10.1 The Bidder shall arrange such transportation of the goods as is required to prevent them from damage or deterioration during transit to their final destination as indicated in the Schedule of Requirements.

10.2 The goods shall be supplied on **"D.D.P"** basis at the Dow University of Health Sciences, Karachi**"** as per Schedule of Requirements on the risk and cost of the Bidder. Transportation including loading/unloading of goods shall be the responsibility of Bidder.

11. INCIDENTAL SERVICES

11.1 The Bidder will be required to provide to the Procuring Agency incidental services the cost of which should be included in the total bid price.

12. WARRANTY / GUARANTEE

12.1 The term period of warranty / guarantee mean the period of twelve **(12) months or in accordance with extended warranty period** form the date on which the Stores have been put into operation and demonstrated to the University staff. In any case this period shall not exceed six months beyond the warranty expiration period from the date of taking-over of goods.

12.2 During the period of warranty / guarantee, the Contractor shall remedy, at his / her expense, all defects in design, materials, and workmanship that may develop or are revealed under normal use of the goods upon receiving written notice from the University; the notice shall indicate in what respect the goods are faulty.

12.3 The previsions of this Clause include all the expenses that the Contractor may have to incur for delivery and installation of such replacement parts, material and equipment as are needed for satisfactory operation of the goods at the University premises.

12.4 The contactor shall provide warranty / guarantee for supply of equipment's for at least 05 years (where applicable).

12.5 The contractor shall remain responsible for providing after sale services even after expiry of warranty / guarantee period and sign a Service Contract including Parts with Procuring Agency for 05 years (minimum). Bidder shall separately quote the price of service contract inclusive of parts.

12 6 The Procuring Agency shall promptly notify the Bidder in writing of any claims arising out of this warranty.

13. PAYMENT

13.1 The method and conditions of payment to be made to the Bidder under this Contract are specified in SCC.

14. ASSIGNMENT

14.1 The Bidder shall not assign, in whole or in part, its obligations to perform to another party under this Contract, except with the Procuring Agency's prior written consent.

15. DELAYS IN THE BIDDER'S PERFORMANCE

15.1 Delivery of the goods shall be made by the Bidder in accordance with the time schedule prescribed by the Procuring Agency in the Schedule of Requirements / Contract Award.

15.2 If at any time in the course of performance of the Contract, the Bidder encounters anything impeding timely delivery of the goods, he shall promptly notify the Procuring Agency in writing of the causes of delay and its likely duration. As soon as practicable, after receipt of the Bidder's notice, the Procuring Agency shall evaluate the situation and may, depending on merits of the situation, extend the Bidder's time for performance, with or without liquidated damages, in which case the extension shall be ratified by the Parties by a supplementary Contract to be treated as an addendum to the original contract.

15.3 Any undue delay by the Bidder in the performance of its delivery obligations shall render it liable to the imposition of liquidated damages.

16. PENALTIES LIQUIDATED DAMAGES

16.1 In case of late delivery, even for reasons beyond control, penalty as specified in SCC will be imposed upon the Bidder / Manufacturer. The Procuring Agency may consider termination of the Contract in case there is an unusual delay in the delivery of the goods whereby the ongoing activity is likely to be affected seriously.

17. TERMINATION FOR DEFAULT

17.1 The Procuring Agency may, without prejudice to any other remedy for breach of Contract, by a written notice of default sent to the Bidder, terminate this Contract in whole or in part if:

(a) the Bidder fails to deliver any or all installments of the goods within the period(s) specified in the Contract, or within any extension thereof granted by the Procuring Agency;

(b) the Bidder fails to perform any other obligation(s) under the Contract to the satisfaction of the Procuring Agency; and

(c) the Bidder, in the judgment of the Procuring Agency, has engaged itself in corrupt or fraudulent practices before or after executing the Contract.

18. FORCE MAJEURE

18.1 The Bidder shall not be liable for forfeiture of its Performance Guaranty/ Bid Security, or termination / blacklisting for default if and to the extent that this delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure. For the purposes of this Clause Force Majeure means an act of God or an event beyond the control of the Bidder and not involving the Bidder's fault or negligence directly or indirectly purporting to mal-planning, mismanagement and /or lack of foresight to handle the situation. Such events may include but are not restricted to acts of the Procuring Agency in its sovereign capacity, wars or revolutions, fires, floods, earthquakes, strikes, epidemics, quarantine restrictions and freight embargoes. If a Force Majeure situation arises, the Bidder shall promptly notify the Procuring Agency in writing with sufficient and valid evidence of such condition and the cause thereof. The Committee, constituted for redressing grievances, will examine the pros and cons of the case and all reasonable alternative means for completion of purchase order under the Contract and will submit its recommendations to the competent authority. However, unless otherwise directed by the Procuring Agency in writing, the Bidder shall continue to perform its obligations under the Contract as far as is reasonably practical and shall seek reasonable' alternative means for performance not prevented by the Force Majeure event.

19. TERMINATION FOR INSOLVENCY

19.1 The Procuring Agency may at any time terminate the Contract by giving written notice of one month time to the Bidder if the Bidder becomes bankrupt or

otherwise insolvent. In that event, termination will be without compensation to the Bidder, provided that such termination will not prejudice or affect any right or remedy which has accrued or will accrue thereafter to the Parties.

20. ARBITRATION AND RESOLUTION OF DISPUTES

20.1 The Procuring Agency and the Bidder shall make every effort to resolve amicably by direct informal negotiations any disagreement or dispute arising between them under or in connection with the Contract.

20.2 If, after thirty (30) days from the commencement of such informal negotiations, the Procuring Agency and the Bidder have been unable to resolve amicably a Contract dispute, either party may require that the dispute be referred to the Arbitrator for resolution through arbitration.

20.3 In case of any dispute concerning the interpretation and/or application of this Contract is to be settled through arbitration, the arbitrator to be appointed with the approval of the University's Syndicate. The decisions taken and/or award given by the sole arbitrator shall be final and binding on the Parties.

21. PACKING

21.1 The Bidder shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to their final destination, as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit, and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the Goods' final destination and the absence of heavy handling facilities at all points in transit.

21.2 The packing, marking, and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the Contract, including additional requirements, if any, specified in SCC, and in any subsequent instructions ordered by the Procuring Agency.

22. GOVERNING LANGUAGE

22.1 The Contract shall be written in English language. All correspondence and other documents pertaining to the Contract, which are exchanged by the Parties, shall be written in English.

23. APPLICABLE LAW

23.1 This Contract shall be governed by the laws of Pakistan and the courts of Karachi - Pakistan shall have exclusive jurisdiction.

C: NOTICE INVITING TENDER (N.I.T)

OFFICE OF THE DIRECTOR PLANNING & DEVELOPMENT

DOW UNIVERSITY OF HEALTH SCIENCES

Baba-e-Urdu Road, Karachi-74200 Pakistan. Direct No. 92-21-9216065 Fax:99216065
Tel: 9215754-57 Ext:5811 Website: www.duhs.edu.pk

No. DUHS/P&D/2022/11300 **Dated: December 26, 2022**

TENDER NOTICE

Dow University of Health Sciences (DUHS), Karachi is a Public Sector University invites the sealed bids for following Services from well-reputed Companies / Bidders available on 'List of Active Tax Payers' of FBR websites (for Income Tax) & SRB (For Sales Tax) and Pakistan Engineering Council (PEC) in appropriate category and specified codesfor following work.

S. No:	NAME OF WORK	METHOD OF PROCUREMENT
1.	ESTABLISHMENT OF PLASMA COLLECTION & PROCESSING FACILITY FOR BBMF DIABAR AT OJHA CAMPUS, DUHS, KARACHI. **(Ref No: DUHS/W&S-NIT/104)**	Single Stage – Single Envelope Procedure as per rule 46 sub rule-2 of SPP Rules 2010 (Amended upto date)
2.	SUPPLY / FIXING / INSTALLATION / TESTING & COMMISSIONING OF HVAC SYSTEM AT PLASMA COLLECTION & PROCESSING FACILITY FOR BBMF DIABAR AT OJHA CAMPUS, DUHS, KARACHI **(Ref No: DUHS/W&S-NIT/105)**	Single Stage – Two Envelope Procedure as per rule 46 sub rule-2 of SPP Rules 2010 (Amended upto date)
3.	**(RE-RE-TENDER)** HIRING OF JANITORIAL SERVICES FOR HEALTH FACILITIES OF DUHS ALONG WITH DOW LAB. COLLECTIONS POINTS IN KARACHI CITY AND ACROSS SINDH PROVINCE BESIDES QUETTA & HUB CITY OF BALUCHISTAN PROVINCE **(Ref No: DUHS/W&S-NIT/106)**	Single Stage – Two Envelope Procedure as per rule 46 sub rule-2 of SPP Rules 2010 (Amended upto date)
4.	**(RE-RE-TENDER)**REPAIR & MAINTENANCE SERVICES FOR PASSENGER LIFTS AND PATIENT / BED LIFTS. **(Ref No: DUHS/W&S-NIT/107)**	Single Stage – Single Envelope Procedure as per rule 46 sub rule-1 of SPP Rules 2010 (Amended upto date)

Tender Fee	**Rs. 2,000/ - (Rupees Two Thousand Only) Non-Refundable in shape of Pay Order / Demand Draft in favor of Dow University of Health Sciences, Karachi.**
Bid Security	**Bid Security amount shall be compliance as mentioned in bidding documents**
Purchasing Date & Time	**From the date of publishing to 16-01-2023 (10 a.m to 02 p.m)**
Bids Delivery & Opening Date & Time	**17-01-2023 at 11:00 a.m & 11:30 a.m.**

Detailed Specification are mentioned in the prescribed tender documents alongwith terms and conditions. Bidding documents can be download from SPPRA website or Dow University of Health Sciences, website. Conditional Bids, Telegraphic Bids, Bids not accompanied by Bid Security of required amount and form, bids received after specific date and time and bids of Black Listed firms will be rejected.

In case of any unforeseen situation or government holiday resulting in closure of office on the date of opening, bids shall be submitted / opened on next working day at the given time.

The Dow University of Health Sciences, Karachi (DUHS) reserves the right to reject any or all the bids subject to the relevant provisions of SPP Rules 2010 (Amended upto date).

ADDRESS FOR PURCHASING OF BIDDING DOCUMENTS, SUBMISSION AND OPENING OF BIDS:

Office of the Director Planning & Development, Dow University of Health Sciences (DMC Campus), 5th Floor Administration Block, Baba-e-Urdu Road near Civil Hospital Karachi.

DIRECTOR

Planning & Development
Dow University of Health Sciences, Karachi

D: BID DATA SHEET

The following specific data for the goods to be procured shall complement, supplement, or amend the provisions in the Instructions to Bidders (ITB). Whenever there is a conflict, the provisions herein shall prevail over those in ITB.

INTRODUCTION

ITB 1.1 Name of Procuring Agency: Dow University of Health Sciences, Karachi.

ITB 1.1 Name of Contract:
SUPPLY / FIXING / INSTALLATION / TESTING / COMMISSIONING OF HVAC SYSTEM AT PLASMA COLLECTION & PROCESSING FACILITY FOR BBMF DIABAR AT OJHA CAMPUS, DUHS, KARACHI

THE BIDDING PROCEDURE

ITB 4.1 Bids shall be accepted under the **Single Stage – Two Envelope Procedure**.

PREPARATION OF BIDS

ITB 7.1 Language of the bid shall be English

ITB 9.6 **For the Goods offered within the Procuring Agency's Country:** the price quoted shall be on **Delivered Duty Paid (DDP) Basis** at Consignee's End.

ITB 10.1 **For the Goods offered within the Procuring Agency's Country:** the price quoted shall be in **Pak Rupees.**

ITB 13.1 The Bid Security shall not be less than **2%** of the total Bid price in Pak Rupees. If bidder elects to submit alternate bid / proposal(s), the Bid Security shall be attached for higher bid amount, otherwise both proposals / bids will be rejected.

ITB 14.1 Bid validity period shall be **90 days**.

ITB 15.1 **Alternate Bids shall not be allowed, if any bidder elects to submit alternative bid(s) / proposal(s), both bids viz. ORIGINAL and ALTERATIVE will be rejected straightaway.**

SUBMISSION OF BIDS

ITB 16.1 (b) The identification of this bidding process is:
SUPPLY / FIXING / INSTALLATION / TESTING / COMMISSIONING OF HVAC SYSTEM AT PLASMA COLLECTION & PROCESSING FACILITY FOR BBMF DIABAR AT OJHA CAMPUS, DUHS, KARACHI.
(REF NO: DUHS/W&S/2022/105)
DDP # DUHS/W&S/2022/11300, DATED: 26-12-2022

ITB 16.1(c) Dow University of Health Sciences, Administration Block, Baba-e-Urdu Road, Karachi.

"Must bear the name of the bidder" and a warning **"Do Not Opened Before the time and date of bid opening".**

ITB 17.1 Deadline for bid submission: **17-01-2023 up to 11:00 a.m.**

OPENING & EVALUATION OF BIDS

ITB 20.1 The bid opening shall take place at:
Dow University of Health Sciences,
Administration Block, Baba-e-Urdu Road, Karachi

Date: **17-01-2023**
Time: **11:30 a.m.**

CONTRACT AWARD

ITB 31.1 Qty. could be increased or decreased during the contract period (including extended period) according to the actual requirement.

ITB 34.1 The successful Bidder shall furnish the Performance Security equivalent to **5%** of the total Contract amount from any scheduled banks in shape of Pay Order / Demand Draft / Call Deposit / Bank Guarantee. The Performance Guarantee/Security Form is provided in the bidding documents. Upon submission of Performance Security / Guarantee the Bid Security would be returned to the Bidder.

E: Special Conditions of Contract (SCC)

1. DEFINITIONS (GCC CLAUSE 1)

GCC 1.1 (g) The Procuring Agency is the Dow University of Health Sciences, Karachi.

GCC 1.1 (h) The Bidder is: _____
(Name and address of the successful bidder)

2. BID SECURITY (ITB CLAUSE 13)

ITB 13.1 The Bidder shall furnish, as part of its financial proposal/bid, refundable Bid Security in Pak Rupees @ **2%** of the total bid value In the shape of Bank Draft / Pay Order / Call Deposit / Bank Guarantee in the name of the Dow University of Health Sciences, Karachi. The financial bid found deficient of the Bid Security will be rejected. No personal cheque in lieu thereof will be acceptable at any cost. The previous Bid Security, if any, will not be considered or carried forward. However, the Bid Security of the successful Bidder will be returned upon submission of Performance Security equal to **5%** of the Contract amount that will remain with the Dow University of Health Sciences, Karachi till satisfactory completion of the Contract period. After delivery and acceptance of the Goods, the performance security shall be reduced to two (2) percent of the Contract Price to cover the Supplier's warranty obligations

3. INSPECTIONS, TESTS AND TRAINING (GCC CLAUSE 7)

GCC 7.1, 7.2 & 7.3 The goods received in the Dow University of Health Services, Karachi from the Bidder will be thoroughly inspected and examine by a Committee to make sure that the goods received conform to the specifications laid down in the bid documents and which have been approved by the Procurement Committee for procurement. The Committee will submit its inspection report, any deficiency pointed out by the Committee shall have to be rectified by the Bidder free of cost. The Bidder will be responsible to provide the Foreign and or Local Training to the University Staff for the specialized Equipment.

4. DELIVERY AND DOCUMENTS (GCC CLAUSE 8)

GCC Clause 8.1 ***(a) For Goods from within the Procuring Agency's country:***

The Bidder shall provide the following documents at the time of delivery of goods to the Store / Warehouse of the Dow University of Health Sciences, Karachi for verification duly completed in all respects:

i. Original copies of Delivery Note (Delivery Challan) (in duplicate) showing item's description, make, model, quantity as well as Lot Number, Batch Number, Registration Number, manufacturing and expiry dates (if applicable).

ii. Original copies of the Bidder's invoices (in duplicate) showing warranty, item's description, make, model as well as Lot Number, Batch Number, Registration Number, manufacturing and expiry dates (if applicable) per

unit cost, and total amount.

iii. Original copies of the Sales Tax Invoices (where applicable) in duplicate showing item's description, quantity, per unit cost (without GST), amount of GST and total amount (with GST).

iv. Manufacturer's or Bidder's warranty certificate.

v. Inspection certificate issued by the nominated inspection committee along with Bidder's factory inspection report.

vi. Certificate of origin.

5. INSURANCE (GCC CLAUSE 9)

GCC 9.1 The goods supplied under the Contract shall be on DDP basis at consignee's end under which risk will be transferred to the Procuring Agency only after it has taken delivery of the goods. Hence insurance coverage is Bidder's responsibility.

6. WARRANTY / GUARANTEE (GCC CLAUSE 12)

GCC 12.1 The goods shall be accompanied by manufacturer standard warranty / guarantee or 1 year or extended warranty, whichever is more.

GCC 12.2 The Procuring Agency shall promptly notify the Bidder in writing of any claims arising out of this warranty.

GCC 12.3 The bidder shall separately quote the price of post warranty service contract inclusive of parts for 5 years (minimum) in term of %age for total contract value.

7. PAYMENT (GCC CLAUSE 13)

GCC 13.1 The method and conditions of payment to be made to the Bidder under this Contract shall be as follows:

i. For Goods supplied from within the Procuring Agency's country:

(a) Payment shall be made in Pak Rupees.

(b) The payment will be made to the Bidder within 30 days of the receipt of original delivery Challan(s) and invoice(s) in duplicate duly completed in all respect and signed and stamped by the Chairman of the Inspection Committee. The Inspection Committee will prepare and submit a report of physical inspection with a certificate to the effect that the goods conform to the specifications laid down in the bidding documents.

8. PENALTIES/ LIQUIDATED DAMAGES (GCC CLAUSE 16)

GCC 16.1 In case deliveries are not completed within the time frame specified in the schedule of requirements / contract, a Show Cause Notice will be served on the Bidder which will be following by cancellation of the Contract to the extent of non-delivered portion of installments. No supplies will be accepted and the amount of Performance Guarantee / Security to the extent of non-delivered portion of supplies of relevant installments will be forfeited. If the firm fails to supply the whole installments, the entire amount of Performance Guarantee/Security will be forfeited to the Government Account and the firm will be blacklisted at least for two years for future participation in bids:

The liquidated damage shall be 0.5 % per week or part thereof. The maximum amount of liquidated damages shall be 10% of the amount of contract. Once the cumulative amount of liquidated damages reaches ten percent (10%) of the amount of the contract, the Procuring Agency shall rescind the contract, without prejudice to other courses of action and remedies open to it.

9. ARBITRATION" AND RESOLUTION OF DISPUTES (GCC CLAUSE 20)

GCC 20.3 Dispute resolution mechanism to be applied shall be as follows:

In case of any dispute concerning the interpretation and/or application of this Contract is to be settled through arbitration, the arbitrator to be appointed with the approval of the University's Syndicate. The decisions taken and/or award given by the sole arbitrator shall be final and binding on the Parties

10. PACKING (GCC CLAUSE 21)

GCC 21.1 The packing, marking and documentation within and outside the packages shall be as per manufacturer standards meeting the safety requirements of the goods.

12. GOVERNING LANGUAGE (GCC CLAUSE 22)

GCC 22.1 The language of this Contract shall be English.

11. APPLICABLE LAWS (GCC CLAUSE 23)

GCC 23.1 The Contract shall be governed by the Laws of Pakistan and the Courts of Pakistan shall have exclusive jurisdiction.

12. NOTICES

Procuring Agency's address for notice purposes:

Dow University of Health Sciences,
Administration Block, Baba-e-Urdu Road, Karachi
Phone No. + 92-21-99216065
Email: _____

Bidder's address for notice purposes:

Name of Bidder: _____

Name of Contact Person & Designation: _____

Phone No. _____

Fax No. _____

Mobile Phone No. _____

Email Address _____

F: SCHEDULE OF REQUIREMENTS

1. SCHEDULE OF REQUIREMENTS

1.1 For Goods supplied from within the Procuring Agency's country (DDP Basis)

i) The entire quantity of the ordered goods shall be delivered within **6 months** or earlier from the date of issuance of supply order / contract award.

ii) The delivery period shall start from the date of contract signature.

G: TECHNICAL SPECIFICATIONS

SUPPLY / FIXING / INSTALLATION / TESTING / COMMISSIONING OF HVAC SYSTEM AT PLASMA COLLECTION & PROCESSING FACILITY FOR BBMF DIABAR, OJHA CAMPUS, DUHS, KARACHI

S. No	DESCRIPTION	Units	QTY
1	2	3	4
1)	**SUPPLY** of DX-VRF Air Handling Unit, Hygiene and Eurovent Certified **(MANDATORY)** (Double Deck with split outdoor VRF condensing unit, Double Skin PU Insulated 60mm thick panel, inner sheet thickness 0.6 mm and outer sheet thickness 1.2 mm. Motor to be of 4 pole. With VFD to set on 40Hz for Supply Airflow, Complete with common base, fan, fan motor, access doors, G4/F6/F9 and H13 Filter with filter section, all three air dampers. Including AHU VRF KIT, all interconnecting copper piping, Y-Joints if any and refrigerant charge. The operating conditions are mentioned in the schedule of Air handling unit. See drawing no. A/C 0322-H116, as per technical specification & drawings. **Preferred Brands: YORK/CARRIER/TRANE/LG/ DUNHAM BUSH OR APPROVED EQUIVALENT,** **Origin: USA/EUROPE/JAPAN/SOUTH EAST ASIA**		
a)	**AIR HANDLING UNITS**		
	1) AHU # 1 Capacity (8.0 TON)	Nos.	1
	2) AHU # 2 Capacity (12.0 TON)	Nos.	1
	3) AHU # 3 Capacity (8.0 TON)	Nos.	1
	4) AHU # 4 Capacity (10.0 TON)	Nos.	2
	5) AHU # 5 Capacity (2.0 TON)	Nos.	1
	6) AHU # 6 Capacity (3.0 TON)	Nos.	2
2)	**SUPPLY** of Variable refrigerant Flow (VRF) AHRI / ARI certified **(MANDATORY)**, Condensing Units, with R410 Refrigerant gas, TOP DISCHARGE-for above 3USRT Capacity and Side/Top Discharge for lower capacities, High -Efficiency DC Inverter Compressor, Low Starting Current, Step less Capacity Control with DC motors, Wide Operating Temperature range up to 46 degree centigrade and should not trip at high ambient temperature of 52 degree centigrade, Low Noise Design, Intelligently Temperature Control. Electrical Details: 380 Volts, 3Phase, 50Hz AC, as per technical specification & drawings **Preferred Brands: YORK/CARRIER/TRANE/LG/ DUNHAM BUSH OR APPROVED EQUIVALENT,** **Origin: USA/EUROPE/JAPAN/SOUTH EAST ASIA**		
a)	**DX-VRF CONDENSING UNITS (COATED FINS)**		
	1) VRF-ODU # 1 Capacity (8.0 TON)	Nos.	1
	2) VRF-ODU # 2 Capacity (12.0 TON)	Nos.	1
	3) VRF-ODU # 3 Capacity (8.0 TON)	Nos.	1
	4) VRF-ODU # 4 Capacity (10.0 TON)	Nos.	2
	5) VRF-ODU # 5 Capacity (2.0 TON)	Nos.	1
	6) VRF-ODU # 6 Capacity (3.0 TON)	Nos.	2

S. NO	DESCRIPTION		UNITS	QTY
1	2		3	4
3)	**INSTALLATION** i.e, Testing and commissioning (i/c lifting, shifting, rigging) of DX-VRF Air Handling Unit, Hygiene and Eurovent Certified **(MANDATORY)** (Double Deck with split outdoor VRF condensing unit, Double Skin PU Insulated 60mm thick panel, inner sheet thickness 0.6 mm and outer sheet thickness 1.2 mm. Motor to be of 4 pole. With VFD to set on 40Hz for Supply Airflow, Complete with common base, fan, fan motor, access doors, G4/F6/F9 and H13 Filter with filter section, all three air dampers. Including AHU VRF KIT, all interconnecting copper piping, Y-Joints if any and refrigerant charge. The operating conditions are mentioned in the schedule of Air handling unit. See drawing no. A/C 0322-H116, as per technical specification & drawings.			
a)	**AIR HANDLING UNITS**			
	1) AHU # 1	Capacity (8.0 TON)	Nos.	1
	2) AHU # 2	Capacity (12.0 TON)	Nos.	1
	3) AHU # 3	Capacity (8.0 TON)	Nos.	1
	4) AHU # 4	Capacity (10.0 TON)	Nos.	2
	5) AHU # 5	Capacity (2.0 TON)	Nos.	1
	6) AHU # 6	Capacity (3.0 TON)	Nos.	2
4)	**INSTALLATION** i.e, Testing and commissioning (i/c lifting, shifting, rigging) of Variable refrigerant Flow (VRF) AHRI / ARI certified **(MANDATORY)**, Condensing Units, with R410 Refrigerant gas, TOP DISCHARGE-for above 3USRT Capacity and Side/Top Discharge for lower capacities, High -Efficiency DC Inverter Compressor, Low Starting Current, Step less Capacity Control with DC motors, Wide Operating Temperature range up to 46 degree centigrade and should not trip at high ambient temperature of 52 degree centigrade, Low Noise Design, Intelligently Temperature Control. Electrical Details: 380 Volts, 3Phase, 50Hz AC, as per technical specification & drawings.			
a)	**DX-VRF CONDENSING UNITS (COATED FINS)**			
	1) VRF-ODU # 1	Capacity (8.0 TON)	Nos.	1
	2) VRF-ODU # 2	Capacity (12.0 TON)	Nos.	1
	3) VRF-ODU # 3	Capacity (8.0 TON)	Nos.	1
	4) VRF-ODU # 4	Capacity (10.0 TON)	Nos.	2
	5) VRF-ODU # 5	Capacity (2.0 TON)	Nos.	1
	6) VRF-ODU # 6	Capacity (3.0 TON)	Nos.	2
5)	**REFRIGERANT PIPING (GAS AND LIQUID)** Refrigerant Piping. Supply and installation of hard drawn seamless following type and sizes Copper refrigerant piping with 1/2" aero-foam foamed insulation with GI cladding, paint, piping kits, oil traps where necessary, complete with fittings and silver soldered joints. (all refrigerant piping shall be carried out under the supervision of VRF A/C equipment supplier). Pipes to be of KEMBLA / Australia, as per technical specification & drawings.			

S. NO	DESCRIPTION		UNITS	QTY
1	2		3	4
	Air Handling Units			
	1) AHU# 1	Capacity 8.0 TR	Rft	50
	2) AHU# 2	Capacity 12.0 TR	Rft	50
	3) AHU# 3	Capacity 8.0 TR	Rft	50
	4) AHU# 4	Capacity 10.0 TR	Rft	100
	5) AHU# 5	Capacity 2.0 TR	Rft	50
	6) AHU# 6	Capacity 3.0 TR	Rft	100
6)	**Split AC Wall Mounted Type**			
	Supply, installation, mini split air conditioner complete with gas charging, refrigerant piping, insulation, drain piping, electric and control wiring for following capacities for tropical region. (Brands: Mitsubishi/Toshiba/Hitachi/LG/Samsung/ Daikin / Daikool or Approved Equivalent, as per technical specification & drawings.			
	Wall Mounted Type (1.5 TR)		Nos.	02
7)	**Condensate Drain Piping**			
	Supply and installation of UPVC Class D condensate drain piping for VRF AC equipment upto drain points 1/4" closed cell synthetic elastomeric foam insulation such as Aero flex-Europe or equivalent. & 8 oz. canvas jacketing, painting & finishing, as per technical specification & drawings.			
	1) Dia 3/4"		Rft	120
	2) Dia 1"		Rft	100
8)	**(a) Rectangular Ducting**			
	G.I sheet metal medium pressure flange type ducting including splitter dampers, take offs, elbows and other necessary fittings, wall/slab sleeves, connections with air-handling units including flexible duct connector, ventilation and exhaust fans including neoprene coated flexible duct connectors, air devices and other equipment complete with all bracings, hangers, supports, access doors, etc and ready for operation in all respect. The duct to qualify EUROVENT classifications B and tested for leakage at site at 4" WC test pressure, as per technical specification & drawings.			
	1) 24 Gauge		Sft	4,100
	2) 22 Gauge		Sft	1,200
	(b) G.I ROUND Duct			
	1) Dia 4" (Rate Only)		Rft	10
	2) Dia 6" (Rate Only)		Rft	10
	3) Dia 8" (Rate Only)		Rft	10
	4) Dia 12" (Rate Only)		Rft	10
9)	**(a) Duct Insulation**			
	Installation of Cross-linked Polyolefin duct Insulation (density 25-30 kg/m3 , Class "O" in Fire, Thermal Conductivity 0.035 W/(m.k) and Zero Permeability) for duct with alupet foil and self-adhesive as specified in technical specification including all labour, material and accessories, complete in all respect and to the satisfaction of Engineer Incharge, as per technical specification & drawings.			

S. NO	DESCRIPTION	UNITS	QTY
1	2	3	4
	1) 12 mm Thick (For Indoor Environment) ON ALL EXHAUST DUCTS	Sft	600
	2) 20 mm thick (For Indoor Environment) ON ALL INDOOR DUCTS ABOVE CEILING and ON ALL INDOOR DUCTS IN TECHNICAL AREA	Sft	4,700
	(b) Round Duct Insulation		
	Installation of Cross-linked Polyolefin duct Insulation (density 25-30 kg/m3 , Class "O" in Fire, Thermal Conductivity 0.035 W/(m.k) and Zero Permeability) for pipe with alupet foil and self adhesive as specified in technical specification including all labor, material and accessories, complete in all respect and to the satisfaction of Engineer Incharge, as per technical specification & drawings.		
	1) Dia 4" (Rate Only)	Rft	10
	2) Dia 6" (Rate Only)	Rft	10
	3) Dia 8" (Rate Only)	Rft	10
	4) Dia 12" (Rate Only)	Rft	10
	(c) SS Cladding of insulated round ducts		
	1) Dia 4" (Rate Only)	Rft	10
	2) Dia 6" (Rate Only)	Rft	10
	3) Dia 8" (Rate Only)	Rft	10
	4) Dia 12" (Rate Only)	Rft	10
10)	**(a) Air Devices**		
	Supply and Fixing of following types and sizes of Air Devices including connections with air ducts and support arrangements. a) H13 HEPA filter following type with housing, perforated/swirl diffusers, DOP test point arrangement and damper arrangement operatable from with the clean room space. Please see the RCP Drawing No.A/C0322-H112 type detail and sketch on Drawing A/C0322-H117, as per technical specification & drawings.		
	1) 18"x18" (12", 305mm thick) With Perforated Diffuser	Nos.	1
	2) 12"x12" (12", 305mm thick) With Perforated Diffuser	Nos.	4
	3) 24"x24" (12", 305mm thick) With Swirl Diffuser	Nos.	10
	(b) Low pickup return & Exhaust box		
	Low pickup return and exhaust box with ss-grills, G4 Filter and M7 Damper (operatable from within clean room space, as per sizes shown in the drawing (A/C0322-H104), as per technical specification & drawings.		
	1) (200X600mm), 8"x24"	Nos.	5
	2) (300X600mm), 12"x24"	Nos.	3
	3) (600X600mm) 24"x24"	Nos.	2

S. NO	DESCRIPTION	UNITS	QTY
1	2	3	4
	(c) Volume Control Dampers		
	Volume Control Dampers, constructed as per SMACNA standards, less then 8" width, single leaf type, 8" and wider multileaf opposed blade type, complete with marking lockable quadrant operator, damper bearings and linkages to be suitable for operation by automatic damper actuator, as per technical specification & drawings.		
	Rectangular Type		
	1) 10"x6"	Nos.	4
	2) 14"x8"	Nos.	1
	3) 14"x12"	Nos.	2
	4) 16"x16"	Nos.	1
	5) 18"x8"	Nos.	1
	6) 20"x10"	Nos.	1
	7) 26"x18"	Nos.	1
	(d) Fresh Air intake louver		
	Fresh Intake louver with G4 filter of following sizes, as per technical specification & drawings.		
	1) 48"x24"	Nos.	1
	(e) Exhaust Air Louvers		
	Exhaust Air Louvers of following sizes, as per technical specification & drawings.		
	1) 48"x24"	Nos.	1
	2) 24"x24"	Nos.	1
	(f) Fire Damper		
	Fire damper for slab application of following sizes with access panel of 18"x18" with fire-stop material filling, as per technical specification & drawings. **UL / FM Certified**		
	1) 12"x12"	Nos.	2
	2) 18"x14"	Nos.	2
	3) 18"x16"	Nos.	6
	4) 30"x18"	Nos.	4
11)	**Exhaust / Fresh Air Fans**		
	Cabinet Type Double Skin Exhaust Air Fan Single Phase Motor With Vfd /Industrial Dimmer, as per technical specification & drawings. BRAND SASA/SHAN INDUSTRIES		
	1) EAFAN-01, 370 CFM, ESP 0.75 IN.WG (ZONE-1)	Set	1
	2) EAFAN-02, 400 CFM, ESP 0.75 IN.WG (ZONE-2)	Set	1
	3) EAFAN-03, 81 CFM, ESP 0.75 IN.WG (ZONE-3)	Set	1
	4) EAFAN-04, 90 CFM, ESP 0.75 IN.WG (ZONE-6)	Set	1
	5) EAFAN-05, 300 CFM, ESP 0.75 IN.WG (ZONE-4)	Set	1
	6) EAFAN-06, 1000 CFM, ESP 0.25 (HORSE RESTRAIN AREA)	Set	1

S. NO	DESCRIPTION	UNITS	QTY
1	2	3	4
	7) FAFAN-01, 1000 CFM, ESP 0.5 IN.WG (HORSE RESTRAIN AREA)	Set	1
	8) FAFAN-02, 3000 CFM, ESP 0.5 IN.WG (FOR AHU ROOM)	Set	1
12)	**(a) Electrical And Control Works**		
	Supply and installation of all electrical wiring in conduit/cable tray from A/C OUTDOOR UNITS to respective indoor split units, as per technical specification & drawings. (PAKISTAN CABLE)		
	1) 1x3C-1.5 sq.mm	Rft	80
	(b) Electric Cabling		
	Supply and installation of all electrical cabling from main to MCCs, and MCC to ODUs/AHUs/EAFAN/FAFAN and all infrastructure cabling including buried in ground, riser with cable ladder, as per technical specification & drawings.		
	1) 1x4C-2.5sqmm CU/PVC/PVC CABLE (From MCC-01 to AHU-01)	Rft	60
	2) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to AHU-01)	Rft	60
	3) 1x4C-2.5sqmm CU/PVC/PVC CABLE (From MCC-01 to AHU-02)	Rft	55
	4) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to AHU-02)	Rft	55
	5) 1x4C-2.5sqmm CU/PVC/PVC CABLE (From MCC-01 to AHU-03)	Rft	40
	6) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to AHU-03)	Rft	40
	7) 1x4C-2.5sqmm CU/PVC/PVC CABLE (From MCC-01 to AHU-04)	Rft	185
	8) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to AHU-04)	Rft	185
	9) 1x4C-2.5sqmm CU/PVC/PVC CABLE (From MCC-01 to AHU-05)	Rft	90
	10) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to AHU-05)	Rft	90
	11) 1x4C-2.5sqmm CU/PVC/PVC CABLE (From MCC-01 to AHU-06)	Rft	140
	12) 1C-1.5sqmm CU/PVC EARTH CABLE From MCC-01 to AHU-06)	Rft	140
	13) 1x4C-4sqmm CU/PVC/PVC CABLE (From MCC-01 to VRF-ODU-01)	Rft	50
	14) 1C-2.5sqmm CU/PVC EARTH CABLE From MCC-01 to VRF-ODU-01)	Rft	50
	15) 1x4C-6sqmm CU/PVC/PVC CABLE (From MCC-01 to VRF-ODU-02)	Rft	40
	16) 1C-4sqmm CU/PVC EARTH CABLE (From MCC-01 to VRF-ODU-02)	Rft	40
	17) 1x4C-6sqmm CU/PVC/PVC CABLE (From MCC-01 to VRF-ODU-03)	Rft	50
	18) 1C-4sqmm CU/PVC EARTH CABLE (From MCC-01 to VRF-ODU-03)	Rft	50

S. NO	DESCRIPTION	UNITS	QTY
1	2	3	4
	19) 1x4C-6sqmm CU/PVC/PVC CABLE (From MCC-01 to VRF-ODU-04)	Rft	150
	20) 1C-4sqmm CU/PVC EARTH CABLE (From MCC-01 to VRF-ODU-04)	Rft	150
	21) 1x4C-6sqmm CU/PVC/PVC CABLE (From MCC-01 to VRF-ODU-05)	Rft	65
	22) 1C-4sqmm CU/PVC EARTH CABLE (From MCC-01 to VRF-ODU-05)	Rft	65
	23) 1x4C-2.5sqmm CU/PVC/PVC CABLE (From MCC-01 to VRF-ODU-06)	Rft	140
	24) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to VRF-ODU-06)	Rft	140
	25) 1-2C-2.5 sq.mm from MCC-01 to All ODUs of Split A/C Units	Rft	250
	26) 1C-1.5sqmm CU/PVC EARTH CABLE From MCC-01 to All ODUs of Split A/C Units)	Rft	140
	27) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Exhaust Fan EF-01)	Rft	40
	28) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Exhaust Fan EF-01)	Rft	40
	29) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Exhaust Fan EF-02)	Rft	40
	30) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Exhaust Fan EF-02)	Rft	40
	31) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Exhaust Fan EF-03)	Rft	40
	32) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Exhaust Fan EF-03)	Rft	40
	33) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Exhaust Fan EF-04)	Rft	40
	34) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Exhaust Fan EF-04)	Rft	40
	35) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Exhaust Fan EF-05)	Rft	50
	36) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Exhaust Fan EF-05)	Rft	50
	37) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Exhaust Fan EF-06)	Rft	60
	38) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Exhaust Fan EF-06)	Rft	60
	39) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Fresh Air Fan FAF-01)	Rft	75
	40) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Fresh Air Fan FAF-01)	Rft	75
	41) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Fresh Air Fan FAF-02)	Rft	75
	42) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Fresh Air Fan FAF-02)	Rft	75
	43) 1x4C-70sqmm CU/PVC/PVC CABLE (From MAIN TO MCC-01)	Rft	50
	44) 1C-35sqmm CU/PVC EARTH CABLE (From Main To MCC-01)	Rft	50

S. NO	DESCRIPTION	UNITS	QTY
1	2	3	4
	(c) MCC		
	Supply, installation & connection of the following MCCs with all mounting accessories and as per specifications & drawings, complete in all respect/wall mounted, as per technical specification & drawings. MAKE (TAJ/KARIMI/ ENGINEERS & ENGINEERING) LOCAL		
	1) MCC-01	Set	1
	(d) Perforated Cable Tray		
	Cable Tray Perforated covered, exposed to outdoor environment, as per technical specification & drawings.		
	1) 0'-6" X 0'-4" G.I PERFORATED CABLE TRAY 16 S.W.G WITH COVER	Rft	180
	2) 1'-0" X 0'-4" G.I PERFORATED CABLE TRAY 16 S.W.G WITH COVER	Rft	140
	(e) Communication Wiring		
	Control/ Communication Wiring	Rft	630
13)	**Direct Digital Controls and BMS System**		
	Direct Digital Control System and Building Management Systems including programming. The transmitter, switches, etc. to be complete with all accessories, control valves with actuators, with communication and display facility, complete in all respects, as per technical specification & drawings. (HONEYWELL/ JHONSON CONTROLS/SIEMENS/SCHNEIDER) (EUROPE/USA/CANADA)		
a)	**AHU-01/02/03/04/05/06 and Standby AHUs / and EAFAN / FAFAN**		
	1) Temperature sensors / transmitter (Balco Type).	Nos.	16
	2) Humidity sensors / transmitter.	Nos.	8
	3) Smoke Detector.	Nos.	8
	4) Pressure differential switches (Filter).	Nos.	24
	5) Arrangement for Indications From VFD for AHU'S Fan.	Lot	8
	6) Arrangement for Indications From VFD for Exhaust Fan	Lot	8
	7) Controlling for Shut-off Damper	Job	16
	8) Relays for AHU fan start/stop	Nos.	8
	9) Relays for Exhaust fan	Nos.	8
	10) Shut-off Dampers for exhaust fan	Nos.	8
	11) Shut-off Dampers for fresh air intake	Nos.	8
	12) Motors for Damper Operation	Nos.	16
	13) Air Flow Station for AHU	Nos.	8
	14) Air Flow Station for Exhaust Fan	Nos.	8
	15) Local controllers with Display. (ModBus / BACKNET)	Nos.	8
	16) Panel / Enclosure for above	Nos.	8
	17) Power supply assembly	Nos.	8
	18) Engineering / Design	Lot	8
	19) Electrical Control Wiring for above	Lot	8

S. NO	DESCRIPTION	UNITS	QTY
1	2	3	4
b)	**Clean Room Monitor**		
	Clean Room Monitor to measure and monitor Temperature, Humidity and Differential pressure, with integrated buzzer for parameter violation alert, individual LED for process violation visual alert and Modbus Communication for easy integration to BMS.	Nos.	8
c)	**Central Control Unit**		
	Central Control Unit, with BMS with remote site monitoring. Complete with computer, software, visual display showing all graphics, parameters, status, operatable from software, refer to drawing A/C 0322-H119	Set	1
d)	**LED Screen**		
	Tablet LED Screen for monitoring at outside the Lab	Set	1
e)	**UPS for BMS**		
	UPS for BMS computer backup power supply of suitable capacity	Set	1
f)	**Electrical Controls**		
	Fan and hood fan electrical/controls interlocking for smooth operation	Job	1
14)	**HVAC related Civil works**		
	All HVAC related civil works including equipment foundation, cutting patching in wall, as per technical specification & drawings.	Job	1
15)	**Air Curtains**		
	Air Curtains for following width for door height of 7 feet.		
	1) 6 feet width	Nos.	2
	2) 3.5 feet width	Nos.	1
	3) 3 feet width	Nos.	2
	4) 2 feet width	Nos.	1
16)	**Shop Drawings**		
	Produce Shop drawings	Set	2
17)	**As-Built Drawings**		
	Produce as built drawings.	Set	3
18)	**Misc. Works**		
	Misc. items to complete the job and make the system functional, as per technical specification & drawings.	Lot	1

SPECIAL NOTE:

i. Confirm delivery period must be provided.
ii. The above specifications are only for widest possible competition and not for favor any single contractor or supplier nor put others at a disadvantage. However, the brand name, catalogue No. / Name etc. has only been used for the reference purpose. Goods offered "AT LEAST EQUIVALENT OR BETTER QUALITY" to requisite specifications shall also be considered.
iii. Equipment must be quoted with all the standard accessories.
iv. Quoted equipment should be of latest Model.
v. All the civil works and support services will be carried-out by the Dow University of Health Sciences, Karachi with the consultation of the responsive bidder.
vi. The bidder shall separately quote the price of service contract inclusive of parts as well as excluding the parts for 5 years (minimum) in term of %age for total contract value.

H: SAMPLE FORMS

1. INTEGRITY PACK

DECLARATION OF FEES, COMMISSION AND BROKERAGE ETC. PAYABLE BY THE SUPPLIERS OF GOODS, SERVICES & WORKS IN CONTRACTS WORTH RS.10.00 MILLION OR MORE

M/s. _____ , the service provider hereby declared that:

(a) Its intention not to obtain the procurement / services / work of any contract, right, interest, privilege, or other obligation or benefit from the DUHS or any administrative or financial offices thereof or any other department under the control of the DUHS through any corrupt practice(s).

(b) Without limiting the generality of the forgoing the bidder / company / firm / agency represents and warrants that it has fully declared the charges, fees, commission, taxes, levies etc, paid or payable to anyone and not give nor agreed to give and shall not give or agree to give to anyone within the DUHS directly or indirectly through any means any commission, gratification, bribe, gifts, kickback whether described as consultation fee or otherwise, with the object of obtaining or including the procurement or service contract or order or other obligations whatsoever from the DUHS, except that which has been expressly declared pursuant hereto.

(c) The bidder / company / firm / agency /accepts full responsibility and strict liability for making any false declaration / statement, not making full disclosure, misrepresenting facts or taking any action likely to degrade the purpose of declaration, representation and warranty. It agrees that any contract / order obtained aforesaid shall without prejudice to any other right & remedies available to the DUHS under any law, contact, or other instrument, be stand void at the discretion of the DUHS.

(d) Not withstanding any right and remedies exercised by the DUHS in this regard, bidder / company / firm / agency agrees to indemnify the DUHS for any loss or damage incurred by it on account of its corrupt business practice & further pay compensation to the DUHS in any amount equivalent to the loss of any commission, gratification, bribe, gifts, kickback given by the bidder / company / firm / supplier / agency / service provider as a fore said for the purpose of obtaining or inducing procurement / work / service or other obligation or benefit in whatsoever from the DUHS.

Dow University of Health Sciences	(Name of Security Firm)
Signature & Seal	Signature & Seal

Note: This integrity pact is mandatory requirement other than auxiliary services / works.

2. PERFORMANCE GUARANTEE/SECURITY FORM

To: [Name & Address of the Procuring Agency]

Whereas **[Name of Bidder]** (hereinafter called "the Bidder") has undertaken, in pursuance of Contract No. **[number]** dated **[date]** to supply **[description of goods]** (hereinafter called "the Contract").

And whereas it has been stipulated in the said Contract that the Bidder shall furnish to the Procuring Agency with a Bank Guarantee by a scheduled bank for the sum of 5% of the total Contract amount as Security for compliance with the Bidder's performance obligations in accordance with the Contract.

And whereas we have agreed to provide a Guarantee: for the said Bidder

Therefore, we hereby unconditionally and irrevocably guarantee, on behalf of the Bidder, up to a total of **[Amount of the Guarantee in Words and Figures]** and we undertake to pay you, upon your first written demand declaring the Bidder to be in default under the Contract and without requiring the Procuring Agency to initiate action against the Bidder and without cavil or argument any sum or sums within the limits of **[Amount of Guarantee]** as aforesaid. The amount stated in the demand made under this guarantee shall be conclusive proof of the amount payable by the Guarantor under this guarantee.

The obligations of the Guarantor under this guarantee shall be valid for four months after the completion of delivery of supplies by the Bidder to the Procuring Agency of the full quantity of the goods for which this Guarantee is being given, and until all and any obligations and sums due have been paid in full.

Signature and Seal of the Guarantors / Bank

Address

Date

3. MANUFACTURER'S AUTHORIZATION FORM

[SEE CLAUSE 11.1 (A) OF THE INSTRUCTION TO BIDDERS]

To: The Dow University of Health Sciences
Karachi.

WHEREAS **[name of the Manufacturer]** who are established and reputable Manufacturers of **[name and /or description of the goods]** having factories at **[address of factory]** do hereby authorize **[name and address of Bidder / Agent]** to submit a bid, and subsequently follow-up / negotiate and sign the Contract with you against Invitation for Bids (IFB) / Tender Notice for the goods manufactured, by us, under the patent name of _____ _____ for performance of the contract.

We hereby commit and assure our full guarantee and warranty / guarantee as per Clause 12 of the General Conditions of Contract for the goods offered for supply by the above mentioned firm against this Invitation for Bids.

[Signature for and on behalf of Manufacturer]

Note:
This letter of authority should be on the letterhead of the Manufacturer and should be signed by a person competent and having the power of attorney to bind the Manufacturer. It should be included by the Bidder in its bid.

4. CONTRACT FORM

THIS AGREEMENT made the_____day of_____2023 between *Dow University of Health Sciences, Karachi* of *Islamic Republic of Pakistan* (hereinafter called "the Procuring Agency") of the one part and ***[Name of Bidder]*** of ***[city and country of Bidder]*** (hereinafter called "the Bidder") of the other part:

WHEREAS the Procuring Agency invited bids for certain goods and ancillary services, viz., ***[brief description of goods and services]*** and has accepted a bid by the Bidder for the supply of those goods and services in the sum of ***[contract price in words and figures]*** (hereinafter called "the Contract Price").

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz.:

(a) the Bid Form and the Price Schedule submitted by the Bidder;
(b) the Schedule of Requirements;
(c) the Technical Specifications;
(d) the General Conditions of Contract;
(e) the Special Conditions of Contract; and
(f) the Procuring Agency's Notification of Award.

3. In consideration of the payments to be made by the Procuring Agency to the Bidder as hereinafter mentioned, the Bidder hereby covenants with the Procuring Agency to provide the goods and services and to remedy defects therein in conformity in all respects with the provisions of the Contract

4. The Procuring Agency hereby covenants to pay the Bidder in consideration of the provision of the goods and services and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the contract at the times and in the manner prescribed by the contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with their respective laws the day and year first above written.

_____	_____
Signed / Sealed by the Manufacturer / Authorized Bidder / Authorized Agent	Signed / Sealed by Procuring Agency

J: BID FORM & PRICE SCHEDULE

1. BID FORM

To: The Dow University of Health Sciences
Karachi

Dear Sir,

Having examined the Bidding Documents, the receipt of which is hereby duly acknowledged, we, the undersigned, offer to supply and deliver the goods specified in the said Bidding Documents for the sum of **[Total Bid Amount Rs.], [Bid Amount in words only]** or such other sums as may be ascertained in accordance with the Schedule of Prices attached herewith and made part of this bid.

2. The free of cost / donation / discounts offered and the methodology for their application are:

3. We undertake, if our bid is accepted, to deliver the goods in accordance with the delivery schedule specified in the Schedule of Requirements.

4. If our bid is accepted, we shall obtain an unconditional guarantee of a bank in the sum of 5% of the Contract Price for the due performance of the Contract, in the form prescribed by the Procuring Agency.

5. We agree to the validity of this bid for 90 days from the date fixed for financial bid opening and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

6. Until a formal Contract is prepared and executed, this bid, together with the written acceptance thereof and notification of award, by the Procuring Agency, shall constitute a binding Contract between us.

7. We understand that you are not bound to accept the lowest or any bid you may receive.

Name _____

In the capacity of _____

Signed _____

Duly authorized to sign the Bid for and on behalf of _____

Date _____

2(A) PRICE SCHEDULE IN PAK RUPEES ON D.D.P BASIS

S. No	Detailed Specification of Goods	Model / Cat No.	Name of Manuf acturer	Country of Origin	Qty	Units	Per Unit Rate without GST	Amount of GST	Per Unit Rate i/c Taxes	Total Amount
1	2	3	4	5	6	7	8	9	10	11
1	**SUPPLY** of DX-VRF Air Handling Unit, Hygiene and Eurovent Certified **(MANDATORY)** (Double Deck with split outdoor VRF condensing unit, Double Skin PU Insulated 60mm thick panel, inner sheet thickness 0.6 mm and outer sheet thickness 1.2 mm. Motor to be of 4 pole. With VFD to set on 40Hz for Supply Airflow, Complete with common base, fan, fan motor, access doors, G4/F6/F9 and H13 Filter with filter section, all three air dampers. Including AHU VRF KIT, all interconnecting copper piping, Y-Joints if any and refrigerant charge. The operating conditions are mentioned in the schedule of Air handling unit. See drawing no. A/C 0322-H116, as per technical specification & drawings. **Preferred Brands: YORK/CARRIER/TRANE/LG/ DUNHAM BUSH OR APPROVED EQUIVALENT** **Origin: USA/EUROPE/JAPAN/SOUTH EAST ASIA**									
a)	**AIR HANDLING UNITS**									
	1) AHU # 1 Capacity (8.0 TON)				1	Nos.				
	2) AHU # 2 Capacity (12.0 TON)				1	Nos.				
	3) AHU # 3 Capacity (8.0 TON)				1	Nos.				
	4) AHU # 4 Capacity (10.0 TON)				2	Nos.				
	5) AHU # 5 Capacity (2.0 TON)				1	Nos.				
	6) AHU # 6 Capacity (3.0 TON)				2	Nos.				
2	**SUPPLY** of Variable refrigerant Flow (VRF) AHRI / ARI certified **(MANDATORY)**, Condensing Units, with R410 Refrigerant gas, TOP DISCHARGE-for above 3USRT Capacity and Side/Top Discharge for lower capacities, High -Efficiency DC Inverter Compressor, Low Starting Current, Step less Capacity Control with DC motors, Wide Operating Temperature range up to 46 degree centigrade and should not trip at high ambient temperature of 52 degree centigrade, Low Noise Design, Intelligently Temperature Control. Electrical Details: 380 Volts, 3Phase, 50Hz AC, as per technical specification & drawings, **Preferred Brands: YORK/CARRIER/TRANE/LG/ DUNHAM BUSH OR APPROVED EQUIVALENT,** **Origin: USA/EUROPE/JAPAN/SOUTH EAST ASIA**									
a)	**DX-VRF CONDENSING UNITS (COATED FINS)**									
	1) VRF-ODU # 1 Capacity (8.0 TON)				1	Nos.				
	2) VRF-ODU # 2 Capacity (12.0 TON)				1	Nos.				
	3) VRF-ODU # 3 Capacity (8.0 TON)				1	Nos.				
	4) VRF-ODU # 4 Capacity (10.0 TON)				2	Nos.				
	5) VRF-ODU # 5 Capacity (2.0 TON)				1	Nos.				
	6) VRF-ODU # 6 Capacity (3.0 TON)				2	Nos.				

2(A) PRICE SCHEDULE IN PAK RUPEES ON D.D.P BASIS

S. No	Detailed Specification of Goods	Model / Cat No.	Name of Manufacturer	Country of Origin	Qty	Units	Per Unit Rate without GST	Amount of GST	Per Unit Rate i/c Taxes	Total Amount
1	2	3	4	5	6	7	8	9	10	11
3 a)	**INSTALLATION** i.e, Testing and commissioning (i/c lifting, shifting, rigging) of DX-VRF Air Handling Unit, Hygiene and Eurovent Certified **(MANDATORY)** (Double Deck with split outdoor VRF condensing unit, Double Skin PU Insulated 60mm thick panel, inner sheet thickness 0.6 mm and outer sheet thickness 1.2 mm. Motor to be of 4 pole. With VFD to set on 40Hz for Supply Airflow, Complete with common base, fan, fan motor, access doors, G4/F6/F9 and H13 Filter with filter section, all three air dampers. Including AHU VRF KIT, all interconnecting copper piping, Y-Joints if any and refrigerant charge. The operating conditions are mentioned in the schedule of Air handling unit. See drawing no. A/C 0322-H116, as per technical specification & drawings. **AIR HANDLING UNITS**									
	1) AHU # 1 Capacity (8.0 TON)				1	Nos.				
	2) AHU # 2 Capacity (12.0 TON)				1	Nos.				
	3) AHU # 3 Capacity (8.0 TON)				1	Nos.				
	4) AHU # 4 Capacity (10.0 TON)				2	Nos.				
	5) AHU # 5 Capacity (2.0 TON)				1	Nos.				
	6) AHU # 6 Capacity (3.0 TON)				2	Nos.				
4	**INSTALLATION** i.e, Testing and commissioning (i/c lifting, shifting, rigging) of Variable refrigerant Flow (VRF) AHRI / ARI certified **(MANDATORY)**, Condensing Units, with R410 Refrigerant gas, TOP DISCHARGE-for above 3USRT Capacity and Side/Top Discharge for lower capacities, High -Efficiency DC Inverter Compressor, Low Starting Current, Step less Capacity Control with DC motors, Wide Operating Temperature range up to 46 degree centigrade and should not trip at high ambient temperature of 52 degree centigrade, Low Noise Design, Intelligently Temperature Control. Electrical Details: 380 Volts, 3Phase, 50Hz AC, as per technical specification & drawings.									
a)	**DX-VRF CONDENSING UNITS (COATED FINS)**									
	1) VRF-ODU#1 Capacity (8.0 TON)				1	Nos.				
	2) VRF-ODU # 2 Capacity (12.0 TON)				1	Nos.				
	3) VRF-ODU # 3 Capacity (8.0 TON)				1	Nos.				
	4) VRF-ODU # 4 Capacity (10.0 TON)				2	Nos.				

2(A) PRICE SCHEDULE IN PAK RUPEES ON D.D.P BASIS

S. No	Detailed Specification of Goods	Model / Cat No.	Name of Manufacturer	Country of Origin	Qty	Units	Per Unit Rate without GST	Amount of GST	Per Unit Rate i/c Taxes	Total Amount
1	2	3	4	5	6	7	8	9	10	11
	5) VRF-ODU # 5 Capacity (2.0 TON)				1	Nos.				
	6) VRF-ODU # 6 Capacity (3.0 TON)				2	Nos.				
5	**REFRIGERANT PIPING (GAS AND LIQUID)**									
	Refrigerant Piping. Supply and installation of hard drawn seamless following type and sizes Copper refrigerant piping with 1/2" aero-foam foamed insulation with GI cladding, paint, piping kits, oil traps where necessary, complete with fittings and silver soldered joints. (all refrigerant piping shall be carried out under the supervision of VRF A/C equipment supplier). Pipes to be of KEMBLA / Australia, as per technical specification & drawings.									
	Air Handling Units									
	1) AHU# 1 Capacity 8.0 TR				50	Rft				
	2) AHU# 2 Capacity 12.0 TR				50	Rft				
	3) AHU# 3 Capacity 8.0 TR				50	Rft				
	4) AHU# 4 Capacity 10.0 TR				100	Rft				
	5) AHU# 5 Capacity 2.0 TR				50	Rft				
	6) AHU# 6 Capacity 3.0 TR				100	Rft				
6	**Split AC Wall Mounted Type**									
	Supply, installation, mini split air conditioner complete with gas charging, refrigerant piping, insulation, drain piping, electric and control wiring for following capacities for tropical region. (Brands: Mitsubishi/Toshiba/Hitachi/LG/Samsung/ Daikin/Daikool or Equivalent, as per technical specification & drawings.									
	Wall Mounted Type (1.5 TR)				2	Nos.				
7	**Condensate Drain Piping**									
	Supply and installation of UPVC Class D condensate drain piping for VRF AC equipment upto drain points 1/4" closed cell synthetic elastomeric foam insulation such as Aero flex-Europe or equivalent. & 8 oz. canvas jacketing, painting & finishing, as per technical specification & drawings.									
	1) Dia 3/4"				120	Rft				
	2) Dia 1"				100	Rft				

2(A) PRICE SCHEDULE IN PAK RUPEES ON D.D.P BASIS

S. No	Detailed Specification of Goods	Model / Cat No.	Name of Manuf acturer	Country of Origin	Qty	Units	Per Unit Rate without GST	Amount of GST	Per Unit Rate i/c Taxes	Total Amount
1	2	3	4	5	6	7	8	9	10	11
8	**(a) Rectangular Ducting**									
	G.I sheet metal medium pressure flange type ducting including splitter dampers, take offs, elbows and other necessary fittings, wall/slab sleeves, connections with air-handling units including flexible duct connector, ventilation and exhaust fans including neoprene coated flexible duct connectors, air devices and other equipment complete with all bracings, hangers, supports, access doors, etc and ready for operation in all respect. The duct to qualify EUROVENT classifications B and tested for leakage at site at 4" WC test pressure, as per technical specification & drawings.									
	1) 24 Gauge				4,100	Sft				
	2) 22 Gauge				1,200	Sft				
	(b) G.I ROUND Duct									
	1) Dia 4" (Rate Only)				10	Rft				
	2) Dia 6" (Rate Only)				10	Rft				
	3) Dia 8" (Rate Only)				10	Rft				
	4) Dia 12" (Rate Only)				10	Rft				
9	**(a) Duct Insulation**									
	Installation of Cross-linked Polyolefin duct Insulation (density 25-30 kg/m3 , Class "O" in Fire, Thermal Conductivity 0.035 W/(m.k) and Zero Permeability) for duct with alupet foil and self-adhesive as specified in technical specification including all labour, material and accessories, complete in all respect and to the satisfaction of Engineer Incharge, as per technical specification & drawings.									
	1) 12 mm Thick (For Indoor Environment) ON ALL EXHAUST DUCTS				600	Sft				
	2) 20 mm thick (For Indoor Environment) ON ALL INDOOR DUCTS ABOVE CEILING and ON ALL INDOOR DUCTS IN TECHNICAL AREA				4,700	Sft				
	(b) Round Duct Insulation									
	Installation of Cross-linked Polyolefin duct Insulation (density 25-30 kg/m3 , Class "O" in Fire, Thermal Conductivity 0.035 W/(m.k) and Zero Permeability) for pipe with alupet foil and self-adhesive as specified in technical specification including all labor, material and accessories, complete in all respect and to the satisfaction of Engineer Incharge, as per technical specification & drawings.									

2(A) PRICE SCHEDULE IN PAK RUPEES ON D.D.P BASIS

S. No	Detailed Specification of Goods	Model / Cat No.	Name of Manufacturer	Country of Origin	Qty	Units	Per Unit Rate without GST	Amount of GST	Per Unit Rate i/c Taxes	Total Amount
1	2	3	4	5	6	7	8	9	10	11
	1) Dia 4" (Rate Only)				10	Rft				
	2) Dia 6" (Rate Only)				10	Rft				
	3) Dia 8" (Rate Only)				10	Rft				
	4) Dia 12" (Rate Only)				10	Rft				
	(c) SS Cladding of insulated round ducts									
	1) Dia 4" (Rate Only)				10	Rft				
	2) Dia 6" (Rate Only)				10	Rft				
	3) Dia 8" (Rate Only)				10	Rft				
	4) Dia 12" (Rate Only)				10	Rft				
10	**(a) Air Devices**									
	Supply and Fixing of following types and sizes of Air Devices including connections with air ducts and support arrangements, **as per technical specification & drawings**. a) H13 HEPA filter following type with housing, perforated/swirl diffusers, DOP test point arrangement and damper arrangement operatable from with the clean room space. Please see the RCP Drawing No.A/C0322-H112 type detail and sketch on Drawing A/C0322-H117.									
	1) 18"x18" (12", 305mm thick) With Perforated Diffuser				1	Nos.				
	2) 12"x12" (12", 305mm thick) With Perforated Diffuser				4	Nos.				
	3) 24"x24" (12", 305mm thick) With Swirl Diffuser				10	Nos.				
	(b) Low pickup return & Exhaust box									
	Low pickup return and exhaust box with ss-grills, G4 Filter and M7 Damper (operatable from within clean room space, as per sizes shown in the drawing (A/C0322-H104), as per technical specification & drawings.									
	1) (200X600mm), 8"x24"				5	Nos.				
	2) (300X600mm), 12"x24"				3	Nos.				
	3) (600X600mm) 24"x24"				2	Nos.				
	(c) Volume Control Dampers									
	Volume Control Dampers, constructed as per SMACNA standards, less then 8" width, single leaf type, 8" and wider multileaf opposed blade type, complete with marking lockable quadrant operator, damper bearings and linkages to be suitable for operation by automatic damper actuator, as per technical specification & drawings.									
	Rectangular Type									
	1) 10"x6"				4	Nos.				
	2) 14"x8"				1	Nos.				

2(A) PRICE SCHEDULE IN PAK RUPEES ON D.D.P BASIS

S. No	Detailed Specification of Goods	Model / Cat No.	Name of Manuf acturer	Country of Origin	Qty	Units	Per Unit Rate without GST	Amount of GST	Per Unit Rate i/c Taxes	Total Amount
1	2	3	4	5	6	7	8	9	10	11
	3) 14"x12"				2	Nos.				
	4) 16"x16"				1	Nos.				
	5) 18"x8"				1	Nos.				
	6) 20"x10"				1	Nos.				
	7) 26"x18"				1	Nos.				
	(d) Fresh Air intake louver									
	Fresh Intake louver with G4 filter of following sizes, as per technical specification & drawings.									
	1) 48"x24"				1	Nos.				
	(e) Exhaust Air Louvers									
	Exhaust Air Louvers of following sizes, as per technical specification & drawings.									
	1) 48"x24"				1	Nos.				
	2) 24"x24"				1	Nos.				
	(f) Fire Damper									
	Fire damper for slab application of following sizes with access panel of 18"x18" with fire-stop material filling, as per technical specification & drawings.									
	UL / FM Certified									
	1) 12"x12"				2	Nos.				
	2) 18"x14"				2	Nos.				
	3) 18"x16"				6	Nos.				
	4) 30"x18"				4	Nos.				
11	**Exhaust / Fresh Air Fans**									
	Cabinet Type Double Skin Exhaust Air Fan Single Phase Motor With Vfd/Industrial Dimmer, as per technical specification & drawings. BRAND SASA/SHAN INDUSTRIES									
	1) EAFAN-01, 370 CFM, ESP 0.75 IN.WG (ZONE-1)				1	Set				
	2) EAFAN-02, 400 CFM, ESP 0.75 IN.WG (ZONE-2)				1	Set				
	3) EAFAN-03, 81 CFM, ESP 0.75 IN.WG (ZONE-3)				1	Set				
	4) EAFAN-04, 90 CFM, ESP 0.75 IN.WG (ZONE-6)				1	Set				
	5) EAFAN-05, 300 CFM, ESP 0.75 IN.WG (ZONE-4)				1	Set				
	6) EAFAN-06, 1000 CFM, ESP 0.25 (HORSE RESTRAIN AREA)				1	Set				
	7) FAFAN-01, 1000 CFM, ESP 0.5 IN.WG (HORSE RESTRAIN AREA)				1	Set				
	8) FAFAN-02, 3000 CFM, ESP 0.5 IN.WG (FOR AHU ROOM)				1	Set				

2(A) PRICE SCHEDULE IN PAK RUPEES ON D.D.P BASIS

S. No	Detailed Specification of Goods	Model / Cat No.	Name of Manuf acturer	Country of Origin	Qty	Units	Per Unit Rate without GST	Amount of GST	Per Unit Rate i/c Taxes	Total Amount
1	2	3	4	5	6	7	8	9	10	11
12	**(a) Electrical And Control Works**									
	Supply and installation of all electrical wiring in conduit/cable tray from A/C OUTDOOR UNITS to respective indoor split units, as per technical specification & drawings. (PAKISTAN CABLE)									
	1) 1x3C-1.5 sq.mm				80	Rft				
	(b) Electric Cabling									
	Supply and installation of all electrical cabling from main to MCCs, and MCC to ODUs/AHUs/EAFAN/FAFAN and all infrastructure cabling including buried in ground, riser with cable ladder, as per technical specification & drawings.									
	1) 1x4C-2.5sqmm CU/PVC/PVC CABLE (From MCC-01 to AHU-01)				60	Rft				
	2) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to AHU-01)				60	Rft				
	3) 1x4C-2.5sqmm CU/PVC/PVC CABLE (From MCC-01 to AHU-02)				55	Rft				
	4) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to AHU-02)				55	Rft				
	5) 1x4C-2.5sqmm CU/PVC/PVC CABLE (From MCC-01 to AHU-03)				40	Rft				
	6) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to AHU-03)				40	Rft				
	7) 1x4C-2.5sqmm CU/PVC/PVC CABLE (From MCC-01 to AHU-04)				185	Rft				
	8) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to AHU-04)				185	Rft				
	9) 1x4C-2.5sqmm CU/PVC/PVC CABLE (From MCC-01 to AHU-05)				90	Rft				
	10) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to AHU-05)				90	Rft				
	11) 1x4C-2.5sqmm CU/PVC/PVC CABLE (From MCC-01 to AHU-06)				140	Rft				
	12) 1C-1.5sqmm CU/PVC EARTH CABLE From MCC-01 to AHU-06)				140	Rft				
	13) 1x4C-4sqmm CU/PVC/PVC CABLE (From MCC-01 to VRF-ODU-01)				50	Rft				
	14) 1C-2.5sqmm CU/PVC EARTH CABLE From MCC-01 to VRF-ODU-01)				50	Rft				
	15) 1x4C-6sqmm CU/PVC/PVC CABLE (From MCC-01 to VRF-ODU-02)				40	Rft				
	16) 1C-4sqmm CU/PVC EARTH CABLE (From MCC-01 to VRF-ODU-02)				40	Rft				
	17) 1x4C-6sqmm CU/PVC/PVC CABLE (From MCC-01 to VRF-ODU-03)				50	Rft				

2(A) PRICE SCHEDULE IN PAK RUPEES ON D.D.P BASIS

S. No	Detailed Specification of Goods	Model / Cat No.	Name of Manufacturer	Country of Origin	Qty	Units	Per Unit Rate without GST	Amount of GST	Per Unit Rate i/c Taxes	Total Amount
1	2	3	4	5	6	7	8	9	10	11
	18) 1C-4sqmm CU/PVC EARTH CABLE (From MCC-01 to VRF-ODU-03)				50	Rft				
	19) 1x4C-6sqmm CU/PVC/PVC CABLE (From MCC-01 to VRF-ODU-04)				150	Rft				
	20) 1C-4sqmm CU/PVC EARTH CABLE (From MCC-01 to VRF-ODU-04)				150	Rft				
	21) 1x4C-6sqmm CU/PVC/PVC CABLE (From MCC-01 to VRF-ODU-05)				65	Rft				
	22) 1C-4sqmm CU/PVC EARTH CABLE (From MCC-01 to VRF-ODU-05)				65	Rft				
	23) 1x4C-2.5sqmm CU/PVC/PVC CABLE (From MCC-01 to VRF-ODU-06)				140	Rft				
	24) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to VRF-ODU-06)				140	Rft				
	25) 1-2C-2.5 sq.mm from MCC-01 to All ODUs of Split A/C Units				250	Rft				
	26) 1C-1.5sqmm CU/PVC EARTH CABLE From MCC-01 to All ODUs of Split A/C Units)				140	Rft				
	27) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Exhaust Fan EF-01)				40	Rft				
	28) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Exhaust Fan EF-01)				40	Rft				
	29) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Exhaust Fan EF-02)				40	Rft				
	30) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Exhaust Fan EF-02)				40	Rft				
	31) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Exhaust Fan EF-03)				40	Rft				
	32) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Exhaust Fan EF-03)				40	Rft				
	33) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Exhaust Fan EF-04)				40	Rft				
	34) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Exhaust Fan EF-04)				40	Rft				
	35) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Exhaust Fan EF-05)				50	Rft				
	36) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Exhaust Fan EF-05)				50	Rft				
	37) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Exhaust Fan EF-06)				60	Rft				
	38) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Exhaust Fan EF-06)				60	Rft				
	39) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Fresh Air Fan FAF-01)				75	Rft				

2(A) PRICE SCHEDULE IN PAK RUPEES ON D.D.P BASIS

S. No	Detailed Specification of Goods	Model / Cat No.	Name of Manufacturer	Country of Origin	Qty	Units	Per Unit Rate without GST	Amount of GST	Per Unit Rate i/c Taxes	Total Amount
1	2	3	4	5	6	7	8	9	10	11
	40) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Fresh Air Fan FAF-01)				75	Rft				
	41) 2x1C-1.5sqmm CU/PVC/PVC CABLE (From MCC-01 to Fresh Air Fan FAF-02)				75	Rft				
	42) 1C-1.5sqmm CU/PVC EARTH CABLE (From MCC-01 to Fresh Air Fan FAF-02)				75	Rft				
	43) 1x4C-70sqmm CU/PVC/PVC CABLE (From MAIN TO MCC-01)				50	Rft				
	44) 1C-35sqmm CU/PVC EARTH CABLE (From MAIN TO MCC-01)				50	Rft				
	(c) MCC									
	Supply, installation & connection of the following MCCs with all mounting accessories and as per specifications & drawings, complete in all respect/wall mounted, as per technical specification & drawings. MAKE (TAJ/KARIMI/ ENGINEERS & ENGINEERING) LOCAL									
	1) MCC-01				1	Set				
	(d) Perforated Cable Tray									
	Cable Tray Perforated covered, exposed to outdoor environment, as per technical specification & drawings									
	1) 0'-6" X 0'-4" G.I PERFORATED CABLE TRAY 16 S.W.G WITH COVER				180	Rft				
	2) 1'-0" X 0'-4" G.I PERFORATED CABLE TRAY 16 S.W.G WITH COVER				140	Rft				
	(e) Communication Wiring									
	Control/ Communication Wiring, as per technical specification & drawings.				630	Rft				
13)	**Direct Digital Controls and BMS System**									
	Direct Digital Control System and Building Management Systems including programming. The transmitter switches, etc. to be complete with all accessories, control valves with actuators, with communication and display facility, complete in all respects, as per technical specification & drawings. (HONEYWELL/JOHNSON CONTROLS/SIEMENS/SCHNEIDER) (EUROPE/USA/CANADA)									
a)	**AHU-01/02/03/04/05/06 and Standby AHUs / and EAFAN / FAFAN**									
	1) Temperature sensors / transmitter (Balco Type).				16	Nos.				
	2) Humidity sensors / transmitter.				8	Nos.				
	3) Smoke Detector.				8	Nos.				
	4) Pressure differential switches (Filter).				24	Nos.				

2(A) PRICE SCHEDULE IN PAK RUPEES ON D.D.P BASIS

S. No	Detailed Specification of Goods	Model / Cat No.	Name of Manufacturer	Country of Origin	Qty	Units	Per Unit Rate without GST	Amount of GST	Per Unit Rate i/c Taxes	Total Amount
1	2	3	4	5	6	7	8	9	10	11
	5) Arrangement for Indications From VFD for AHU'S Fan.				8	Lot				
	6) Arrangement for Indications From VFD for Exhaust Fan				8	Lot				
	7) Controlling for Shut-off Damper				16	Job				
	8) Relays for AHU fan start/stop				8	Nos.				
	9) Relays for Exhaust fan				8	Nos.				
	10) Shut-off Dampers for exhaust fan				8	Nos.				
	11) Shut-off Dampers for fresh air intake				8	Nos.				
	12) Motors for Damper Operation				16	Nos.				
	13) Air Flow Station for AHU				8	Nos.				
	14) Air Flow Station for Exhaust Fan				8	Nos.				
	15) Local controllers with Display. (ModBus / BACKNET)				8	Nos.				
	16) Panel / Enclosure for above				8	Nos.				
	17) Power supply assembly				8	Nos.				
	18) Engineering / Design				8	Lot				
	19) Electrical Control Wiring for above				8	Lot				
b)	**Clean Room Monitor**									
	Clean Room Monitor to measure and monitor Temperature, Humidity and Differential pressure, with integrated buzzer for parameter violation alert, individual LED for process violation visual alert and Modbus Communication for easy integration to BMS.				8	Nos.				
c)	**Central Control Unit**									
	Central Control Unit, with BMS with remote site monitoring. Complete with computer, software, visual display showing all graphics, parameters, status, operatable from software, refer to drawing No. A/C 0322-H119.				1	Set				
d)	**LED Screen**									
	Tablet LED Screen for monitoring at outside the Lab				1	Set				
e)	**UPS for BMS**									
	UPS for BMS computer backup power supply of suitable capacity.				1	Set				
f)	**Electrical Controls**									
	Fan and hood fan electrical/controls interlocking for smooth operation.				1	Job				
14)	**HVAC related Civil works**									
	All HVAC related civil works including equipment foundation, cutting patching in wall.				1	Job				
15)	**Air Curtains**									
	Air Curtains for following width for door height of 7 feet.									
	1) 6 feet width				2	Nos.				

2(A) PRICE SCHEDULE IN PAK RUPEES ON D.D.P BASIS

S. No	Detailed Specification of Goods	Model / Cat No.	Name of Manufacturer	Country of Origin	Qty	Units	Per Unit Rate without GST	Amount of GST	Per Unit Rate i/c Taxes	Total Amount
1	2	3	4	5	6	7	8	9	10	11
	2) 3.5 feet width				1	Nos.				
	3) 3 feet width				2	Nos.				
	4) 2 feet width				1	Nos.				
16)	**Shop Drawings**									
	Produce Shop drawings				2	Set				
17)	**As-Built Drawings**									
	Produce as built drawings				3	Set				
18)	**Misc. Works**									
	Misc. items to complete the job and make the system functional, as per technical specification & drawings				1	Lot				
	GRAND TOTAL									

Name_____ In the capacity

NOTE:

The "Origin" means the place where the "goods" are mined, grown, or produced.

K: DETAIL TECHNICAL SPECIFICATION

TECHNICAL SPECIFICATIONS

1.0 GENERAL:

The contract drawings indicate the extent and general arrangement of the air-conditioning system. Equipment, ductwork and piping shall fit into the space allotted and shall allow adequate and acceptable clearance for entry, servicing and maintenance. Where component parts of equipment or system cannot be serviced without distributing adjacent work resulting from original installation of other work, corrective action satisfactory to the DUHS's Engineer shall be taken, without any additional cost to the Owner.

(a) Capacities of equipment and materials shall not be less than those indicated.

(b) Conformance with Agency requirements: Where materials or equipment are specified to conform to requirements of Underwriter's laboratory, Inc., Air-conditioning and Refrigeration Institute of Heating, Refrigeration and Air-conditioning Engineers, etc., the Contractor shall submit proof of conformance. The label or listing of the specified agency will be acceptable evidence.

(c) Nameplates: Each major item of equipment shall have the manufacturer's name, address serial and model numbers on a plate securely attached to the item.

(d) Protective and Access requirements: Belts, pulleys, chains, gears, coupling, projecting set-screws, keys and other rotating parts are so located that any person in close proximity shall be fully enclosed or properly guarded. High temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type specified in Clause - THERMAL INSULATION. Items such as catwalk ladders and quadrails shall be provided where indicated for safe operation and maintenance of equipment.

(e) Verification of dimensions: The Contractor shall visit the premises to thoroughly familiarize himself with all details of the work and working conditions and verify all dimensions in the field, and shall advise the DUHS's Engineer of any discrepancy before performing any work. The Contractor shall be specifically responsible for the co-ordination and proper relation of his work to the building structure and to the work of all trades.

(f) Pipes and ducts crossing fire rated wall, the gap between wall and pipe/duct shall be filled with fire stop material (Hilti), the ends shall be closed with gauge 16 duct sleeves or approved sealant shall be deemed to have been included in the relevant items.

(g) The heating, ventilation, cooling and air conditioning systems shall be in accordance with ASHRAE, SMACNA, ASME and NFPA except as modified by rules, regulations and by-laws of authorities having jurisdiction.

1.1 EQUIPMENT AND MATERIAL:

(a) General:

These shall conform to the respective publications and other requirements specified

herein, and as shown on the drawings and shall be the products of the manufacturers regularly engaged in the manufacture of such products. Items of equipment shall essentially be duplicate of equipment that has been in satisfactory use at least 5 years prior to bid opening and shall be supported by a service organization that is, in the opinion of the DUHS's Engineer, reasonably convenient to the site. It shall be solely the Contractor's responsibility to ensure that the equipment supplied by him shall fit into the space allotted for the purpose. If at any stage it is detected that the equipment supplied by him cannot fit into the space provided for the equipment, then the Contractor shall be responsible for supplying other equipment of suitable size, without incurring any additional cost to the Owner.

(b) Approval of Equipment and Material:

Before starting installation of any material or equipment, the Contractor shall submit to the DUHS's Engineer for approval working drawings of all areas and lists of materials and equipment to be incorporated in the work. The layout drawings shall include a plan and elevations of the proposed piping, ductwork and equipment to establish that the equipment will fit in the allotted space with clearances for installation and maintenance. The drawings shall show proposed details for attachment anchoring, and hanging to structural framing of the building; vibration isolation units; foundation and support; location and size of sleeves and prepared openings for passage of pipes and ducts. If departures from the contract drawings are deemed necessary by the Contractor, details of such departures including changes in related portions of the project and the reasons thereof shall be submitted with the drawings. Approved departures shall be made at no additional cost to the Owner. A complete electrical connection diagram, for each electrically controlled component having more than automatic or manual control device, shall be submitted to the DUHS's Engineer for approval in addition to the automatic temperature control diagram required hereinafter. Wiring diagrams shall identify each component and one diagram shall show all interconnected or interlocked components. The lists of materials and equipment shall be supported by sufficient descriptive material, such as catalogs, diagrams, performance curves, charts, layout drawings and other data published by the manufacturer, to demonstrate conformance to the specification requirements; model numbers alone will not be acceptable. The data shall also include the name and address of the nearest service and maintenance organization that regularly stock repair parts. Listings of items that function as parts of an integrated system shall be furnished at one time. One copy of the layout drawings, wiring diagrams and lists will be returned, marked to indicate approval. All material shall be submitted to the DUHS's Engineer for approval and only approved material shall be supplied to the site.

1.2 SAMPLES:

The contract shall provide at his cost, samples of material, instruments, gauges and electrical items, for approval by the Engineer before order is placed for the same. Engineer may waive this requirement, if detailed published catalogues submitted by the contractor provide sufficient information for approval. These samples shall include but not limited to:

1. G.I Sheet, each gauge to be used
2. Copper Pipes and Fittings
3. Pressure Gauges and Thermometers etc.
4. Duct Insulation, Liner and Covering
5. Pipe Insulation and Covering
6. Insulation Adhesive and Tapes
7. Air devices (Diffusers, Grilles, Registers)
8. OA / EA Louvers
9. All types of Dampers
10. Power and Control Cables
11. Electrical Items, Push Buttons, HOA & Toggle Switches, Pilot Lamps, Contractor, Relays, Circuit Breakers and Isolating Switches
12. Vibration Isolating Springs, Pipe Hangers, Duct Hangers and Rollers
13. Copper Piping, Condensate Drain Piping, GI Piping

1.3 FACTORY INSPECTION OF EQUIPMENT AND MATERIALS:

All major equipment listed below to be supplied under this Contract which has been manufactured or shop assembled in or outside Pakistan shall be subject to inspection by the Employer's two numbers authorized representatives for each equipment at manufacturer's factory of origin before its dispatch to site. The Contractor shall make necessary arrangements and provide all the facilities required for such inspection. The Contractor to arrange travel, boarding and lodging for 02 persons on his expense.

The following equipment shall be inspected and tested at the manufacturer's place:

1. VRF OUTDOOR UNITS
2. Air Handling Units
3. Motor Control Centre (MCC)

2.0 LOW VELOCITY HIGH STATIC PRESSURE VRF-DX-AIR HANDLING UNITS:

2.1 Air handling units as shown on the drawings, low velocity type shall be provided for various areas of the Building and shall be of capacities under the specified conditions of operation as given in the AHUs Schedule Operating Conditions. All components to be heavy duty type and suitable for continuous operation.
The Units installed outdoors to have weather proof construction.

2.2 The unit shall be complete with cooling/heating coil(s), fan(s), fan motor(s), direct drive, dampers (VCDs) as specified, internal face and bypass dampers for single zone units if specified in the Schedule, multizone units to have segmented zone face and bypass dampers, perforated plate in the bypass section (if heating coil not installed) to balance air resistance across the cooling coil, filter section(s) suitable for filters specified elsewhere, plenum sections with access doors for high efficiency filters, eliminators if

required, mixing box with VCDs as shown in the drawings or specified, SS316L drain pan and all other components and accessories to complete the unit.

2.3 The casing shall be modular type, panels of best quality not less than 1.2mm thick sheet steel, properly reinforced and braced for maximum rigidity, with smooth internal and external surfaces and to have removable panels and access doors for easy access to all internal parts.

2.4 Double Skin (DS) Units. Where specified, units of double skin construction shall be supplied. DS units shall have insulation sandwiched between two steel sheets, internal to be min. 0.6mm thick and external 1.2mm thick. The casing panels and access doors to be formed by sheets folded together at edges with smooth internal and external surfaces. The panels to be supported between sturdy aluminium corners/frame work or equivalent arrangement.

Internal/external sheets may be of material other than steel as specified in the Schedule.

The insulation may be min. 70Kg.cum density rigid board type or foamed in place polyurethane. Units 60 mm thick panels.

The integrity and quality of insulation to prevent sweating of panels and panel joints with ambient dew point of 29°C.

Unit sections thru which air at ambient temperature only is flowing may not be insulated and be of single skin construction.

2.5 The unit sections requiring draining (coils, humidifiers, eliminators) shall be installed on a common base frame to act as a drain pan with drain outlet connection on both sides. The construction shall be sandwich type, bottom & sides completely insulated to maintain 60mm thick panel with foamed-in-place insulation without any joint, to prevent sweating with ambient dew point of 29°C.

2.6 To provide easy access to all internal parts, the casing shall have access doors or inspection panels of same construction, with inner surface flush and smooth with adjoining surfaces, tightly sealed with sealing gasket and easy to open or close, provided with handles and locks fitted with operating knobs. Units of upto 1.5cum.sec (4200cfm) capacity may have removable type panels/doors with hand grip bolts and larger sizes with access doors hinged type or hung on hand grip bolts.

2.7 The casing panel sheets and supporting frame work to be corrosion protected, bonderised and powder paint coated or baked enamel finished, or as specified in the Schedule of Equipment.

2.8 Multi leaf opposed blade type air volume control dampers (VCDs) shall be provided in the mixing box and other sections as specified in the Schedule or shown in the drawings.

The damper blades to be interlinked with nylon construction gear wheels at one end to ensure simultaneous smooth movement of all blades. Damper blades fitting within the frame to allow minimum air leakage from the sides. The blades to interlock on closure for effective air seal. Damper operating lever with lock screw and quadrant having Open to Close position indicator to be provided.

Segmented zone face and bypass dampers of multizone units to have linkage to ensure simultaneous close/open operation.

All damper blades rods provided with ball bearings and linkages of construction and design to be easily movable with minimum force and suitable for operation by automatic controls damper actuators. Nylon bushings may be approved instead of ball bearings;

metallic bushings not to be used.

2.9 The different components of each unit section to be fixed through the casing to two external base channels so that the unit is not in contact with the floor.

The design of the unit should make site assembly work quick and easy. The assembly will be only with nuts and bolts and clamps. The assembled panels shall form a strong and rigid casing.

2.10 The casing shall be tested to be air tight against a positive pressure of 150mm wg (1500 pascal), and negative pressure of 100mm wg (1000 pascal), or higher if specified.

2.11 The fans to be plug type and statically and dynamically balanced and tested in the factory.

Fan to be selected for quiet operation, max. 2000rpm, fan outlet velocity not to exceed 10m.s (2000 fpm) or as specified, fan outlet connected to the casing with short flexible collar of heavy duty airtight canvas properly sewn and clamped, max. 1450 rpm electric motor.

The fan motor to be suitable for Variable Frequency Drive, of protection Class IP44, if specified or in open locations Class IP54 or IP55 and selected so as not to be loaded more than 90% of net rated HP under specified operating conditions. The fan motor to be mounted on a sturdy adjustable base.

The fan motor may be located inside or outside the unit casing.

The units with fan motor installed outside the casing, shall be installed on rubber-in-shear or similar approved vibration isolators to isolate the units from the Building structure.

The units with fan motor inside the casing shall have both fan and motor installed on a common sturdy base mounted on rubber-in-shear or similar vibration isolators and isolated from the unit casing and other sections. External vibration isolators for the unit not to be provided in this case.

2.12 The cooling/heating coil(s) shall be of heavy gauge seamless copper tubes with mechanically bonded aluminium fins, tested with atleast 20 bar air pressure in a water tank. Unless otherwise specified the cooling and cooling/heating coils shall have not more than 4 fins/cm (10 fins/inch) and face velocity not to exceed 2.5m.s (500 fpm) and heating coils to have not more than 5fins/cm (12 fins/inch) and face velocity not to exceed 5.1m.s (1000 fpm). The unit design to ensure that the air flow is uniform across the coil face.

2.13 If specified the coils to have protective coating for corrosion protection against sea air. The tenderer to furnish details of the protective coating.

2.14 The conditions of operation for the units, coil capacities, water pressure drop through the coil, steam supply pressure, etc. shall be as given in the AHUs Schedule of Operating Conditions. Coil capacity ratings shall be ARI certified for units of USA origin.

2.15 In selecting the units, the tenderer shall carefully check and confirm that the units can be installed and conveniently serviced and maintained within the respective spaces indicated on the drawings for unit installation.

2.16 All air handling units shall be selected to provide noise level of not more than NC 40 in the air-conditioned space. The Contractor shall be responsible for evaluation of the noise level of the AHU and to incorporate sound attenuators, if required, to provide the noise level specified in the space, no additional cost and no variation or claim shall be entertained in this regard.

2.17 General: The Contractor shall be responsible for installation of the Air Handling Units, as shown on the drawings, complete in all respects and as per satisfaction of the DUHS's Engineers. The installation shall be carried out complete in all respects as per recommendations of the manufacturer and as specified herein. Pipe connections, duct connections, flexible connections, electrical connections, drain connections, etc. shall be done by the Contractor, complete in all respects.

2.18 Foundation: Foundation shall consist of 6" (150 mm) concrete pads constructed of 1:2:4 cement concrete. The foundation shall be isolated from the structure and AHU / machine room floor by using 2" (50 mm) thick higher density cork sheet. The foundation shall be finished with 3/16" thick cement plaster, edges shall be chamfered.

2.19 Commissioning & Testing: The unit shall be commissioned and tested as per the Manufacturer's recommendations. Drives shall be adjusted to provide the required airflow rate and valves shall be adjusted for the proper water flows, etc.

2.20. The tenderer to supply the following information:

(a) Unit construction details.

(b) The overall unit dimensions and operating weight.

(c) Coil(s) construction, face area, number of fins per cm (or inch), face air velocity, air resistance, water pressure drop.

(d) Type of fan, fan rpm, air velocity at fan outlet, unit noise level rating in dBA, fan HP requirement, fan motor HP & rpm, air flow capacity cum.sec (or cfm) and total static pressure at which the fan selected.

(e) Manufacturer's performance guarantees certificate and technical bulletins including coil capacity tables and fan performance curves.

3.0 VRF CONDENSING UNIT

3. 1 General

Specification for VRF Condensing Units:

3.1.1 Variable refrigerant Flow (VRF) System, with R410 Refrigerant gas, having Air cooled Condensing unit suitable for installation at ground level, rooftop, wall hung, and or balcony/ledge mounting. A reliable system with all DC inverter Compressors having High Pressure Switch, Phase Protection, restart Relay, Self-Diagnosis Function, Soft Starting. Having Brushless DC (BLDC) Concentration Electric Motor or better. Units shall be capable for reversible function as the outdoor component of an air-to-air heat pump system.

3.1.2 Special Coating for protection against Corrosion for installation of worst coastal environments (near/ or on face of sea side) is required for each condensing unit. Post coated epoxy and anti-corrosive polyester (120 µm with a tolerance of +/- 20 µm) are recommended for Outdoor unit's parts such as brackets, panels (exterior), Screws, Heat Exchangers, fins and tubes Fan with Fan Motor, Grills. Subject to Engineer's approval.

3.1.3 Average EER/COP in Cooling Mode for Condensing units from 8HP to 20HP to be minimum 4.0 or higher at standard operating conditions. (Outdoor temp. 35 deg. C DB/ 24 deg. C WB, Indoor temp. 27 deg. C DB/19 deg. C WB).

3.1.4 Hermetically Sealed Scroll Inverter Compressors of latest Generation, having updated/available latest technologies to increase efficiencies, technologies such

as smart oil return and high pressure oil return or better are recommended /required in Compressors.

3.1.5 Heat Exchangers to be Variable flow type for Heating and cooling mode for Optimum Performance in each mode.

3.1.6 Power Emergency Operation: A System for Limiting power consumption of all AC units to be provided so that when electric power supply is shifted from normal to generators, a limit can be set for each outdoor unit power consumption resulting in limiting cooling capacity in each apartment.

3.1.7 Wireless individual remote control to be provided for each indoor unit of each apartment. A central controller for each apartment to be provided.

3.1.8 Condensing units Outdoor fan to be propeller Type with DC inverter motor with a min. static pressure of 100 Pa. Protection against Over heat and Fan Driver over Load. Preferred if the same capacity centrifugal fan is offered.

3.1.9 All Condensing units to be installed in space designated for outdoor unit such as apartment balconies/roof top and or ledges etc. The units installed in balconies / ledges (and or where as advised by the Engineer) to be provided with suitable Air guides to make air discharge through vertical Louvers for side discharge.

3.1.10 Units shall be used in a refrigeration circuit matched to ducted or duct-free heat pump fan coil units of various types as specified in the schedule/BOQ.

3.1.11 The systems shall capable of one or a number of outdoor units connected via interconnecting refrigeration pipe work to multiple indoor units using simple Y, T or Header type branch pipe connectors. The systems shall have manufacturer standard component in addition to above, must be complete in all the necessary electronic controls board and control wiring to maintain the design room conditions without external controller.

3.1.12 Manufacturer's Recommendation and approval to be provided for installation of Outdoor units before commencing installation work.

3.1.13 All outdoor units are to be permanently marked with an identification number. The removable access panels are also to be marked with the same number.

3.1.14 Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure shall be all factory installed pre-wiring, piping, controls, and the compressor.

3.1.15 The outdoor unit shall have the full capacity control to meet the load fluctuation up to 130% and indoor unit individual control, however units shall must be selected strictly on minimum 100% operating capacity of indoor units.

3.2 Unit access panels shall be removable with minimal screws and shall provide full access to the compressor, fan, and control components, the fan must be inverter driven variable speed propeller type fan.

3.3 Compressor shall be isolated and have an acoustic wrap to assure quiet operation.

3.4 Compressor compartment shall be isolated to allow performing diagnostics while the system is running.

3.5 Outdoor fan(s) shall be direct-drive propeller type, and shall discharge air horizontally. Fans shall draw air through the outdoor coil.

3.6 Outdoor fan motor(s) shall be totally-enclosed, inverter driven with permanently-lubricated ball bearings. Motor shall be protected by internal thermal overload protection.

3.7 Shaft shall have inherent corrosion resistance.

3.8 Fan blades shall be non-metallic and shall be statically and dynamically balanced.

3.9 Outdoor fan openings shall be equipped with non-metallic protective grille over fan.

3.10 The fan will be capable of overcoming a minimum of 100 Pascal of external static pressure, subject to the wind pressure at project site location, the outdoor shall be provided with guided fiber glass frame based out let must be customized to mount of non-returned air foil based damper, the Aluminum sheet (heavy gauge) self-closing damper shall be provided by contractor.

3.11 Compressor shall be equipped with oil system, operating oil charge, and motor. Internal overloads shall protect the compressor from over-temperature operation.

3.12 Motor shall be suitable for operation in an R-410A refrigerant atmosphere.

3.13 Compressor assembly shall be installed on rubber vibration isolators.

3.14 Coil shall be constructed of aluminum fins mechanically bonded to seamless copper tubes, which are cleaned, dehydrated, and sealed.

3.15 The capacity control of the outdoor units shall be inverter controlled and shall be determined electronically by sensing operational temperatures, pressures and ambient temperature and monitoring requirements for the indoor units.

3.16 The units shall be complete with electronic pulses based expansion valve(s), oil separator(s), high pressure switches, fan motor safety devices, over current relay, Refrigerant Cooled inverter overload protection, fuses, necessary solenoid valves, refrigerant shutoff valves, re-cycling guard timer and all necessary sensors for a safe and trouble free operation.

3.17 Operating controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include the following:

- A time delay sequence is provided in the inverter control.
- Automatic outdoor-fan motor speed control.
- Diagnostics provided by inverter control.
- Compressor motor current and temperature protection.
- Outdoor fan failure protection (High Pressure Switch).
- Low pressure protection.
- Fusible plug to vent refrigerant safely in case of a fire.

3.18 Refrigerant Line Lengths:

a. Total Allowable Piping length = 1000m;
b. Allowable maximum actual longest pipe length = 200m;
c. Allowable height difference from outdoor to indoor units= 110m;
d. Allowable height difference from indoor to indoor unit = 40m

3.19 Special Features:

a. Crankcase oil temperature regulation by inverter control.
b. User activated forced defrost cycle.
c. User activated refrigerant pump down cycle.
d. Outdoor fan can be controlled to accommodate minimum external static pressure change.
e. The access to the internal components for maintenance purposes shall be by removable panels.

f. It shall be possible to connect up to 32 indoor units, capacity permitting, to one modular outdoor unit.

g. The units shall be equipped with Auto Restart function, which allows the unit to start in the same mode prior to the power failure.

3.20 Standards

a. Unit construction shall comply with ANSI/ASHRAE 15, latest revision, and with the NEC.

b. Units shall be evaluated in accordance with UL standard 1995 or latest.

c. Units shall be listed in the CEC directory.

d. Unit cabinet shall be capable of withstanding 500-hour salt spray test per Federal Test Standard No. 141 (Method 6061).

e. Certificate of Acceptance for Test Method B of ISO21207: Salt Contaminated condition + severe industrial or traffic environment, or approved equivalent.

3.21 SPECIAL CONDITIONS

3.21.1 DESIGN CONDITIONS

HVAC System has been designed for the conditions listed hereunder. These conditions are being given for the information of the Contractor to enable him to perform specified tests under these conditions.

3.21.2 OUTSIDE DESIGN CONDITIONS

a) Summer Dry Bulb Temp: 115° F (46°C)
Wet Bulb Temp: 86° F (30°C)
Daily range: 14° F (7.7°C)

b) Winter Dry Bulb Temp: 49° F (9.4°C)

c) Latitude: (27.7°) North.

3.21.3 INSIDE DESIGN CONDITIONS (AIR-CONDITIONED AREAS)

Summer

a) All air-conditioned areas 73.4°F ± 2°F (23 °C ±2°C)
50% + 10% RH

4.0 ELECTRIC MOTORS

4.1 Electric motors shall be of the sizes and types as specified for driving all plant and equipment. The motors shall be of atleast the horsepower specified but shall be of proper horse-power and speed to suit the specific plant and equipment offered by tenderer. Any adjustment in motor horsepower or speed must be included in the tender and no additional cost will be allowed on this account. The motors shall be heavy duty quiet running type suitable for continuous operation under the site conditions. The minimum motor efficiency and power factor shall be 0.85.

4.2 The motors shall be designed for 50 cycle AC supply of following voltage characteristics:

	Imported	**Indigenous**
Fractional HP, 1-phase	220±10%	220±10%
1 HP & above, 3-phase	400±10%	400+5%-10%

4.3 All motors shall be constant speed type unless otherwise specified but suitable for running with VFD. 3-phase motors, 150 HP and below shall be squirrel cage type and above 150 HP slipring type. Squirrel cage motors 10HP and above shall have 6 winding leads brought to motor terminal block for star-delta starting. Single phase motors shall be split phase type or capacitor start induction run type.

4.4 The motors shall be tropicalized and fungus proof. Unless otherwise specified, drip proof ventilated or totally enclosed fan cooled construction with Class IP44 Protection for indoor installation, totally enclosed fan cooled weather proof construction with Class IP54 Protection for outdoor installation or where coming in contact with high humidity air. The motors and starters shall be suitable for operation under site conditions as specified; minimum ambient temperature 45^0C and altitude 600m amsl. Where required, motors installed outside shall be provided with sheet metal cover to protect from direct sun.

4.5 The motors to have cast iron frame with cast in cooling ribs, integral feet and cast in end shields, protective cover for cooling fan, quiet running ball or roller bearings to meet the specified duty, terminal box and grease nipples in upper part of end shields to be accessible while motor is running. Motors to be suitable for direct or pulley drive.

4.6 All motors should be arranged for quiet operation and guaranteed to give the required output and fulfil the requirements of the driven machinery without producing any sound audible outside the machine room.

4.7 The slipring motors shall have inspection windows for access to brushes and slip rings. Rotor connections shall be made thru a cable gland or terminal box. There shall be a safety control to ensure that the motor cannot be started without the brushes in position.

4.8 All motors provided under this contract should be of one manufacturer except for the equipment where special motors and starters are provided as standard component. The Contractor shall submit manufacturers' technical bulletins of motors to the DUHS's Engineer for approval before supply.

4.9 Special fire resistant, explosion proof, 2-speed or multi speed motors and starters shall be supplied if specified elsewhere in the documents.

5.0 FILTERS

5.1 <u>H-13, 99.95% EFFICIENCY BANK/TERMINAL HEPA FILTERS</u>

5.1.1. The air filters shall be minipleat filter cells. It shall be especially designed for high volume flows, high dust holding capacities and extended service life consisting of galvanized steel casing and high quality wet-strength glass fiber paper media folded into closely spaced narrow pleats uniformly spaced by spacers. The filter components shall be machine assembled to guarantee high stability. The casing is fitted with grooved neoprene or fluid seal gasket for secure sealing between filter cell and filter mounting bank.

5.1.2 The Hepa air filters to have greater than 99.95% efficiency with 0.15-0.25 micron (MPPS) DOP smoke particles quantity relative test method. In accordance with

HEPA Testing Standard EN1822 and Federal Standard 209E and to have UL586 label.

5.1.3 (a) Terminal Application. Maximum face velocity of 1.6 m/s for 292 mm depth, 0.75 m/s for 150mm depth and 0.45 m/s for 75mm depth. Initial pressure drop not more than 175 pascal and limit of final pressure drop to be given by the tenderer. Recommended size as indicated in the Schedule. (The tenderer may vary the depth to suit the air flow and pressure drop requirements.

5.1.4 (b) Bank Application

Maximum face velocity of 2 m/s for 292mm depth, 1m/s for 150 mm depth and 0.45 m/s for 75mm depth. Initial pressure drop not more than 175 pascals and limit of final pressure drop to be given by the tenderer. Recommended size as indicated in the Schedule.

5.1.5. (a) <u>Filter mountings for Hepa Filter Banks in AHUs/Fans.</u>

The filter mounting bank consisting of gastight frame system in welded aluminum sections shall be provided to make air tight leak proof installation in the Air handling unit filter sections.

Cell support angles of Aluminum to ensure correct cell alignment of minipleat HEPA filters cells shall also be provided.

Turn-buckle clamps arrangement made of galvanized components to ensure good airtight sealing between cell frame and mounting frame shall be provided for installation/ removal of filter cells from dirty side.

The framing system to ensure leak proof system at 1500 Pascal test pressure.

5.1.4. (b) **<u>Terminal Hepa Housings.</u>**

The terminal Hepa housings shall have room withdrawal arrangement. The housing shall be gas tight welded stove enameled steel casing 450-600mm high, with secure sealing and clamping device for filter Cell/Panel, Flanged top air entry, filter replacement from bottom, filter integrity test arrangement, pressure differential measuring points and terminal ceiling diffusers.

The air filters shall be TROX/CAMFIL/AAF/MGT, or approved equal and packed in damage resistant packing.

<u>5.2 PANEL TYPE G-4 AND F-9 FILTER, BAG TYPE F-6 AND F-8 FILTERS:</u>

5.2.1 Pre-Filters (G-4). Panel Type with metallic holding frames, 2.5m/s, initial resistance not over 70 pascal and filter media shall be regenerative type.

The filter grade shall be G-4 according to EN 779 and average synthetic dust weight arrestance shall not be less than 90%.

Filters shall be provided complete, consisting of holding frame and installation frames.

5.2.2 Front withdrawal type F-6 and F-8 Bag type air filters to be with holding frames, gaskets, etc. Maximum face velocity 2 m/s, recommended size as per schedule of filters, initial resistance for F-6 filters not over 70 pascals and F-8 filters not over 110 pascals. Recommended size as indicated in the Schedule.

The filter grade shall be according to EN 779 and atmospheric Dust SPOT average efficiency shall not be less than 65% for F-6 and 95% for F-8 filters respectively.

Filters shall be Bag type filter inserts having long service life with high and constant dust extraction efficiencies, high stability of filter elements and low pressure loss even under large air flows.

Filter media shall be of high quality spun fiber glass media specifically made for separation of fine dust, suspended particles and aerosols or approved equal.

5.2.3 Filters shall be provided complete, consisting of cell (holding) frame, installation frame, special installation frames for installation in duct/ AHUs and required amount of flat steel stiffeners for special installation frames.

5.2.4 Panel filters G-4 TROX/CAMFIL/AAF/MGT, F-6 to be TROX/CAMFIL/AAF/MGT, and F-8 to be TROX/CAMFIL/AAF/MGT, or approved equal.

5.3 ALL AIR FILTERS

5.3.1 25% spare filter cells for each size and type to be offered.

5.3.2 The tenderer to furnish the following information for each type of air filters:

(a) Size, capacity in Cu.M/h face velocity and velocity through filtering media.

(b) Average minimum efficiency of each type according to the specified test method.

(c) Initial and recommended final operating air resistances in pascal for each type of air filters.

(d) Overall dimensions of each type of air filter and operating weight.

(e) Manufacturer's Performance Guarantee Certificate and technical bulletins.

6.0 AIR COOLED SPLIT AIR CONDITIONING UNIT

6.1 Electrically operated, Refrigerant-HFC 410A split units cooling type air conditioner with remote air cooled condensing unit of minimum capacity as specified in Schedule of Equipment or in BOQ. The condensing unit to be complete with compressors, air cooled condensers, condenser fans, fan motor, controls, casing and safety devices and all other accessories to complete the unit. The fan coil unit to be suitable for installation within the space and as indicated on the drawings.

6.2 INDOOR UNIT

Indoor Unit shall be wall mounted type. The casing shall be constructed of galvanized steel. The units shall be provided with decorative plastic side panels and return grille/filters on the front of the unit. Drain pan shall be double walled insulated, epoxy resin coated rolled steel plate insulated with fire retardant foam coating with removable drain pan extended beyond coil to serve connections. Fans shall be forward curved centrifugal direct driven type double width

double inlet type. Bearings shall be permanently lubricated sealed ball bearings. Motors shall operate on 220 volt 50 Hz power and shall be suitable for multi- speed control from manual selector and shall be tapped wound permanent split capacitor type with UL listed thermal overload protection. Maximum sound power level shall not exceed 56 dB at 250 cps. The direct expansion cooling coil shall be fabricated of copper tubes with mechanically bonded aluminum fins, and tested to 31 bar pressure and suitable for working pressures up to 24.1 bar.

6.3 CONDENSING UNIT

The air cooled condenser shall have ample surface area to meet the specified capacity requirements, weather proof construction with galvanized steel casing, copper tubes with mechanically bonded aluminum fins, working pressure 24.1 bar, propeller or axial flow type galvanized fans with vertical upward or side air discharge, totally enclosed fan motors with automatic direct on line magnetic starters. The condenser should preferably have liquid sub cooling arrangement. The compressors shall be hermetically sealed reciprocating or Rotary type complete with suction and discharge valves with connections for pressure gauges, suction gas cooled motor having internal thermal over load protection in each phase winding, internally spring mounted to provide quiet free floating operation forced feed lubrication system with built-in anti-sludging device. The unit shall be complete with operating charges of refrigerant and oil and all interconnecting piping controls and accessories

6.4 CONTROLS

Provide thermostat and three speed on-off selector switch for each unit suitable for remote wall mounting. The tenderer shall supply the following information. (a) Capacity of unit. (b) Motor BHP. (c) CFM capacity and static pressure of DX evaporator. (d) Manufacturer's performance guarantee certificate. (e) Over all dimensions.

6.5 EXECUTION

Installation work shall include all rigging, setting, aligning and grouting necessary to prepare equipment and its integral parts for normal continuous operation. All installation work shall be done according to best practice and recommendations of equipment manufacturer.

7.0 PIPING, FITTING AND FLANGES:

Copper piping shall be seamless pipe ASTM B88 type K plain ends with wrought copper fitting ANSI B16.22

Condensate drain piping shall be UPVC class D ASTM D1785 or BS3505 with solvent welded fitting for installation not expose to view and GI pipe class B (medium) BS1387 with threaded fittings for installation on roof and within plant room.

7.1 INSTALLATION:

(a) General:

Pipes shall be cut accurately to measurements established at the job site and worked

into place without springing or forcing, properly clearing all windows, doors and other openings. Excessive cutting or other weakening of the building structure to facilitate piping insulation will not be permitted without written approval. Layout drawings required under the title of **"APPROVAL OF MATERIAL AND EQUIPMENT"** shall show locations of all supports, the load imposed on each fastening or anchor, typical details for special anchorage, and details for special anchorage for supports attached to metal roof decking, for suspended piping, valves, tank, pumps, converters, and other mechanical equipment. Supports shall be attached to metal decking. Where supports are required between structural framing shall be provided and detailed. Pipe shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints and hangers. Changes in direction shall be made with fittings, except that bending of pipe bender is used and wide sweep bends are formed. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks wrinkles, flattening or other mal-formations will not be accepted. All piping shall be installed with sufficient pitch to ensure adequate drainage and venting. Piping connections to equipment shall be provided with unions or flanges. Open ends of pipelines or equipment shall be properly capped or plugged during installation to keep dirt and other foreign matters out of the system.

7.1.1 Pipe Supports:

(a) General: pipe hangers, brackets, saddles, inserts, clamps and pipe rolls including rods, bolts, turn buckles, bases and protection shields shall conform to standard recommended engineering practice, using stock or production parts wherever possible. Chain, wire, strap or other makeshift devices will not be permitted as hangers or supports.

Accurate weight balance calculations shall be made to determine the required supporting force at each hanger location and pipe weight load at each equipment connection. Pipe hangers shall be capable of supporting the pipe in all conditions of operations. They shall allow free expansion and contraction of the piping, and prevent extra stress resulting from transferred weight being included in the pipe or connected equipment. Hangers shall be supported from beams, clamps, concrete inserts Phillips concrete fasteners, and power actuated drive pins. Concrete inserts when used shall be installed in the exact location prior to the pouring of the concrete.

(b) Suspended Horizontal Piping: shall be supported by adjustable hangers or supports, which shall provide a means of vertical adjustment after erection. Unless otherwise indicated on drawings maximum spacing between pipe supports for straight runs of pipe shall be in accordance with recommended spacing shown in accordance with recommended spacing shown in the table given below:

Nominal Pipe Size	0.5	0.75	1	1.5	2	2.5	3	4	5	6	8	10
Inches (mm)	-13	-20	-25	-40	-50	-65	-75	-100	-	-	-200	-

									125	150		250
Maximum Span Feet (Meters)	5	6	7	9	10	11	12	14	16	17	19	22
	-1.5	-1.8	-2.1	-2.7	-3	-3.3	-3.6	-4.2	-4.8	-5.2	-5.8	-6.7
Rod Size dia mm.	10	10	10	10	10	13	13	16	16	19	22	22

Pipe hangers and supports shall be spaced not over 5 feet (1.5m) apart at heavy fittings and valves.

A hanger shall be installed not over 1 foot (0.3m) from each change in direction of piping. Where necessary to prevent vibration transmission, the support closest to the sources of vibration shall be spring cushion, or other approved type of isolation hanger. Where the piping system is subject to shock loads, such as thrusts imposed by the actuation of safety valves, hanger design shall include provision of shock absorbing devices of approved design. Hangers shall be designed so that they cannot become disengaged by movements of the supported pipe.

(c) Vertical Piping: shall be guided or supported in the center of each riser but not over 15 feet on center and shall be supported at the base of the riser on a base elbow or tee with a pipe stand only where required. For un-insulated brass or copper pipe or tubing, the riser clamp shall be compatible nonferrous or electrolytic ally coated steel as for hangers.

(d) Piping in trenches: Pipes shall rest on suitable wall floor supports with rollers.

(e) Pipe Sleeves: Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction or afterwards if necessary. Each sleeve shall extend through its respective wall, floor or roof and shall be cut flush with each surface. Sleeves shall be of such size as to provide a minimum of 1/4" all around clearance between bare pipe and sleeve or between jacket over insulation and sleeve. Sleeves in bearing walls shall be steel or cast iron pipe. Sleeves in non-bearing walls, floors, or ceiling may be steel pipe, cast iron pipe or G.I. sheet metal gauge 14, with lock type longitudinal seam. Sleeves in bearing walls shall be steel or cast iron pipe.

8.0 LOW VELOCITY LOW/MEDIUM PRESSURE SHEET METAL DUCTING

8.1 All sheet metal work for various air systems shall be furnished, installed, completely connected, tested and adjusted.

8.2 The Contractor shall make shop drawings of all duct work and the same shall include details of all splitters, takeoffs, vanes, dampers, elbows and all other necessary fittings required for the proper operation of the air systems. Shop drawings and other details shall be submitted to the DUHS's Engineer for approval before fabrication.

8.3 Exact dimensions and locations of diffusers, registers, grilles and louvers shall be submitted to the DUHS's Engineer for approval, otherwise any changes directed after

installation shall be made by the Contractor without any additional cost to the Employer. For diffusers and registers adequate provision shall be made in the neck connections for installation of deflectors and dampers.

8.4 All duct openings, diffuser, register and grille necks/ boxes must be tightly closed during construction to keep out rubbish.

8.5 All ducts passing through walls shall have 20 gauge G.I. sheet sleeves extending 6mm beyond the finished face of the wall on both sides. The sleeves shall be of sufficient size to cover duct insulation or any other duct covering and allow atleast 9mm clearance in the sleeve for free movement of the finished ducting. The clearance shall be filled with fiberglass pads or other approved material at fire walls and similar locations. The Contractor shall be responsible for supplying, locating and setting of all necessary duct sleeves.

8.6 All sheet metal duct work shall be fabricated from commercial quality prime finish galvanised steel sheets. The specifications for USA and Canadian sources shall be base steel sheets according to ASTM designation A366:62T and zinc coating according to 525-64T, 1.25 oz./sq.ft. and for all other sources base steel sheets cold rolled B.S. 1449:Part 1B:1962 and zinc coating according to B.S. 2989:1958 Class D, 1.25 oz./sq.ft. The zinc coating should be applied uniformly by continuous hot dip method to both sides of the base metal so that the sheet metal can be drawn, formed, lock-seamed and spun without danger of flaking or peeling off the zinc coating.

8.7 All uninsulated ducts shall be cross broken. Insulated ducts not to be cross broken.

8.8 All ducting shall be substantially built with approved joints and seams shall be made smooth on the inside and neat on the outside. The duct joints shall be made as air tight as possible. The laps shall be made in the direction of air flow and no flanges shall project inside the ducting.

8.9 Ducts, the width of the greater dimension of which exceeds 30 inches shall be constructed of not more than four feet sections. Ducts, the width of the greater dimension of which is 30" or less shall be constructed of not more than eight feet sections.

8.10 All elbows shall preferably be full radius type. If space does not permit, square elbows may be used with double thickness shop fabricated turning vanes rivetted with the ducting. Due to space limitations curved elbows with less than a full radius bend may also be used provided single thickness turning vanes are installed in the elbow. Full radius elbows of widths 40"-60" shall have one and over 60" shall have two single thickness turning vanes. Minimum throat radius of any curved or square elbow shall be 3 inches.

8.11 Wherever necessary in duct work, casings or sheet metal partitions, suitable access doors and frames shall be provided to permit inspection, operation and maintenance of valves, controls, fire dampers, filters, bearings, traps or other apparatus concealed behind the sheet metal work. Access doors shall also be provided at distance not exceeding 23m for duct cleaning. All such doors shall be of double construction, of not less than 20 gauge G.I. sheet metal and shall have sponge rubber gasket around the entire perimeter to make the joint airtight. They shall be hung on heavy flat hinges and shall be secured in the closed position by means of wing type catches. In no case shall access to any of the items of equipment requiring inspection, adjustment or servicing require the removal of nuts, bolts, screws, wedges or any other screwed or loose device.

8.12 The supply and return air duct connections with the fans and equipment shall be made through heavy duty air tight pre-fabricated flexible duct connector to prevent transmission of vibrations. The flexible duct connector will have 75mm 24g G.I. sheet, 150mm of fabric and 75mm 24g G.I. sheet. The fabric shall be fixed with G.I. sheets with double-lock grip. The fabric shall be non-combustible heavy glass fabric double coated with fire retardent neoprene to become fully water proof and air tight of approx. 30oz weight per sq.yd. The flexible connector shall be Duro-Dyne Super Metal Fab or approved equal.

8.13 The ducts shall be adequately supported from hangers firmly fixed and generally suspended from the building structure with the help of concrete inserts, rawl bolts or shooting bolts. The hangers and supports shall not pierce the insulation which shall be suitably protected and reinforced at that location. The bottom support shall be 30x6mm M.S. flat or 25x3mm angle for ducts upto 12" width, 30x3mm angle upto 30" width, 40x3mm angle upto 72" width and 50x5mm angle upto 96" width. Hangers shall be spaced on average 3 meter centres with a hanger no further than 300mm on each side of any changes of direction. Ducting passing through building expansion joints shall be supported on either side of joint. The hangers for horizontal ducts shall be 9mm round rods for ducts upto 30" width, 12mm round rods or 40x3mm M.S. flat upto 72" width and 40x5mm M.S. flat upto 96" width. The vertical ducts shall be supported at each floor with M.S. angle or channel supports resting on slab and bolted with the duct bracing or MS flat straps rivetted with the duct. Perforated band or wire shall not be used in any case for supporting the ducts.

8.14 The low pressure ducting with static pressures upto 50mm wg and velocities upto 10mps, shall be fabricated according to the following schedule:

Rectangular Ducting	
To 8" larger dimension	26 gauge (all four sides)
9"-27" larger dimension	24 " "
28"-51" " "	22 " "
52"-81" " "	20 " "
Above 81" " "	18 " "

8.15 The ducts shall be fabricated with following type of joints or as approved:

(a) Longitudinal

Pittsburgh lock, double seam, or grooved seam.

(b) Circumferential (all four sides):

Duct larger dimension	
To 23"	Drive slip
24" - 42"	1" high pocket lock or standing seam
43" - 72"	1-1/2" high pocket lock or standing seam
73" - 96"	1-1/2" high reinforced pocket lock or standing seam

8.16 The bracing for ducting shall be as follows:

Duct larger dimension	Size of bracing MS angle
to 23"	None
24"-30"	Joints at 4' centres without bracing or joints at 8' centres with

	25x25x3mm bracing between joints.
31" - 42"	25x25x3mm bracing @ 4ft centres
43" - 72"	40x40x3mm " @ 4 "
73" - 84"	40x40x3mm " @ 2 "
85" - 96"	40x40x5mm " @ 2 "

The 2' centres bracing would be located at joints and between joints.

The bracing shall be carried around all four sides, bracing angle frame welded at 4 corners and riveted with the ducts at maximum 150mm centres.

8.17 Special joints, bracing and hangers as specified by the DUHS's Engineer shall be used for ducts with larger dimension over 96".

8.18 The medium pressure ducting with static pressures upto 150mm wg and velocities upto 15mps, shall be fabricated according to the following schedule:

Rectangular Ducting

To 18" larger dimension	24 gauge (all four sides)
19"-45" larger dimension	22 " "
46"-69" " "	20 " "
Above 69" " "	18 " "

8.19 The ducts shall be fabricated with following type of joints or as approved:

(a) Longitudinal

Pittsburgh lock, double seam, or grooved seam.

(b) Circumferential (all four sides):

Duct larger dimension

To 18"	1" high pocket lock, standing seam or bar slip.
19" - 36"	1-1/2" high pocket lock or standing seam.
37" - 48"	Reinforced standing seam with 40x40x3 mm angle or 32x32x3 mm companion angle flanged joint.
49" - 60"	40x40x3 mm companion angle flanged joint.
61" - 84"	50x50x5 mm companion angle flanged joint.

The companion angle flanged joints shall have neoprene gasket to make the joint air tight.

8.20 The bracing for ducting joints at 4 ft centre shall be as follows:

Duct larger dimension	Size of bracing MS angle
to 12"	None
13" - 24	25x25x3mm bracing between joints.
25" - 36"	32x32x3mm " @ 2 ft centres
37" - 48"	40x40x3mm " @ 2 "
49" - 60"	50x50x3mm " @ 2 "
61" - 84"	75x75x5mm " @ 2 "

The 2' centre bracing would be located at joints and between joints.

The bracing shall be carried around all four sides, bracing angle frame welded at 4 corners and rivetted with the ducts at maximum 150mm centres.

8.21 Special joints, bracing and hangers as specified by the DUHS's Engineer shall be used for ducts with larger dimension over 84".

8.22 The ducting and air dampers shall be furnished to comply with these specifications and latest edition of SMACNA Duct Construction Standards. Where there is a conflict between the two, these specifications will prevail.

9.0 THERMAL INSULATION:

9.1 GENERAL:

The Contractor shall install the insulation on ducting, piping, etc., as specified below. Installation shall be done as per the following specification. The insulation shall be provided as per List of Approved Manufacturer's or equivalent make subject to the approval of DUHS's Engineer.

9.2 PIPING INSULATION:

(a) Installation of Cross-linked Polyolefin duct Insulation (density 25-30 kg/m3, Class "O" in Fire, Thermal Conductivity 0.035 W/(m.k) and Zero Permeability) for duct with alupet foil and self-adhesive tape.

(b) Condensate Drains: shall be insulated with 1/4" thick closed cell synthetic elastomeric foam insulation such as Aero Flex-Europe or equivalent.

9.3 DUCT INSULATION:

(a) Cross-linked Polyolefin duct Insulation (density 25-30 kg/m3, Class "O" in Fire, Thermal Conductivity 0.035 W/(m.k) and Zero Permeability) for duct with Alupet foil and self-adhesive including all material and accessories, complete in all respect and to the satisfaction of Engineer In charge. Insulation shall be continuous and no gaps, crevices and other discontinuities shall be acceptable. All gaps shall cover 100% surface area of the duct and insulation and joint shall be overlapped 50mm. All exhaust air duct heading toward energy recovery wheel or passing through plenum in the Air-conditioned areas shall also be insulated with 25-mm insulation to avoid any condensation.

9.4 INSTALLATION:

9.4.1 Duct insulation: The insulation shall be fixed to the duct with a good quality fire-resistant, approved adhesive. Adhesive shall cover at least 75% of duct area. Sheet metal hooks only will not be allowed. At all elbows, tees or turnings insulation shall be applied in such a way as to allow the insulation to be installed flush with the duct. Insulation shall be continuous, and no gaps, crevices, or other discontinuities shall be acceptable. All gaps remaining shall be filled up with fiber glass scrim.

(a) Vapor barrier shall be fixed to the insulation with a good quality, fiber resistant adhesive, approved by the DUHS's Engineer. All circumferential and longitudinal joints shall be lapped at least 1.5 inches. Vapor barrier shall be completely continuous. All scratches, tears, etc. shall be made good by pasting fresh layers of Kraft paper on the discontinuity. Adhesive shall cover at least 75% of the insulation area.

(b) Jacketing & cladding shall be done, on exposed to atmosphere ductwork.

9.4.2 Pipe Insulation: No insulation shall be applied to any system of piping until all pipe work has been tested, cleaned out and made tight. All insulation shall be applied in a manner consistent with good practice and methods. All longitudinal joints of pipe shall be at the top and bottom. Insulation shall be continuous through walls, floors, ceiling and partitions etc.

Chilled Water Piping: shall be insulated with preformed sectional Rubber form insulation. All insulation shall be fixed to the pipe with a good quality, fire resistant, approved adhesive. Insulation shall be continuous and gaps if any shall be filled up with insulation yarn scrim and bounded with twine. Circumferential and longitudinal joints of vapor barrier and jacket shall be overlapped at least 50 mm. Soft aluminum bands shall be installed at every 450 mm.

9.4.3 Cladding: All insulated pipes in the central plant room and where expose to atmosphere shall be provided with a cladding of 26 gauge G.I. sheet metal. At all flanges and Valves shall be provided with valve boxes with quick opening clamps.

The cladding shall be painted with one coat of primer and two coats of finish paint.

10.0 DIFFUSERS, REGISTERS AND GRILLES:

10.1 GENERAL:

These shall be factory fabricated of anodized Aluminum extruded sections or stainless steel for HEPA filter housing and shall distribute the specified quantity of air evenly over space intended, without causing noticeable drafts, or dead spots anywhere in the conditioned area. The Contractor shall confirm with the Architect regarding the interior color scheme of the building to match the colors and type of the diffusers and grills. The Contractor shall be responsible for diffusion, spread, drop and throw. If, according to the certified data of the manufacturer of the proposed units, the sizes indicated on the drawings will not perform satisfactory, the units shall be re-selected to perform quietly and effectively in accordance with the manufacturer's recommendations as approved by the DUHS's Engineer.

A schedule of all air inlets and outlets shall be submitted to the DUHS's Engineer, indicating location, types, specified air quantity, neck or face velocity, sound power level values, pressure drop, throw and drop for registers and maximum and minimum diffusion range, prior to ordering. Diffusers and registers shall be provided with opposed blade volume controller with accessible key operator. The manufacturer of these units shall be as per list of approved manufacturers.

1. The cutting of false ceiling (tiles) shall be the responsibility of the HVAC contractor.
2. All air inlet and outlets shall be manufactured as per turtle & belly standards of air inlets / outlets.
3. Diffusers connected to VAV systems shall be the non-dumping type.
4. The interior of all grilles and diffusers is to be factory painted matt black.
5. All grilles, diffusers and registers shall be tested to the requirements of ASHRAE and ADC and ARI.

All grilles and diffusers supplied on this project shall be tested and rated in accordance with ASHRAE standard 70-72, ADC Test code 1062-GRD and ISO 3741.

Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air flow performance of outlets and inlets" and ARI 650 "Standard for air outlets and inlets" Test and rate louvers in accordance with AMCA 500 "Test Method for louvers, dampers, and shutters"

10.2 DIFFUSERS:

10.2.1 Shall be square, rectangular, slot, strip shape or perforated type with fixed or adjustable air discharge pattern, as indicated in the drawings. Ceiling mounted units shall be furnished with anti-smudge device, unless the diffuser unit minimizes ceiling smudging through design features. Diffusers shall be provided with air deflectors specified herein. Ceiling mounted units shall be installed with trims tight against ceiling whether flush, recessed or surface mounted. Sponge rubber gasket shall be provided between ceiling and surface mounted diffusers, when necessary for air leaking-control. Suitable trim shall be provided for flush mounted diffusers.

10.2.2 H13 HEPA filter housing, shall have perforated/swirl diffusers, DOP test point arrangement and damper arrangement operatable from within the clean room space.

10.3 REGISTERS:

Shall be four-way directional-control type except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply registers face. Registers shall be provided with sponge rubber gaskets between flanges and walls or ceilings. Wall supply registers shall be installed at least 150 mm (6") below the ceiling unless otherwise indicated. Type of registers shall be as indicated on the drawings or approved.

10.4 RETURN GRILLES:

Shall be of sizes shown on the drawings and shall consist of fixed louvers at 40^{o} angle along the longer side and shall not be provided with control dampers unless otherwise indicated on drawings.

10.5 LOUVERS:

Louvers shall be extruded aluminum frame with aluminum blades of not less than 2 mm thickness, and shall be firmly fixed so as not to vibrate. Unsupported blade width shall not exceed 1800mm. behind each louver there shall be an insect mesh screen 76 x 6 mm made from 2 mm diameter stainless steel wire. The screen will be clamped by a 20 mm frame and will be firmly fixed to the outer edges of the louver. The frame shall be hot dip galvanized after fabrication. The connection to the louver shall be flexible and shall ensure no duct load is transmitted to the louver. Louvers shall be provided with powder coated finish to the approval of the engineer.

10.6 AIR DAMPERS

10.6.1 In all duct work the Contractor shall furnish and install factory fabricated dampers (VCDs) for proper control of air volumes and balancing of air distribution systems or for closing/ opening of air systems.

These dampers shall be separate from any other dampers provided with supply, return and exhaust air diffusers, registers and grilles or provided by the manufacturer in the equipment.

10.6.2 A multi leaf opposed blade type damper shall be installed in each zone supply air duct near the multizone type air handling unit outlet to adjust the supply air cfm of each zone.

10.6.3 Dampers shall be factory fabricated, of rigid construction, free of all rattling and vibrations with edges crimped or creased for stiffness.

Damper blades fitting within the damper frame to allow minimum air leakage from sides.

All dampers blades rods provided with ball bearings and linkages of construction and design to be easily movable with minimum force and suitable for operation by automatic controls damper actuators. Nylon bushings may be approved instead of ball bearings; metallic bushings not to be used.

10.6.4 All dampers shall have through rods, not less than 9mm diameter, fastened to blade with two or more yokes with set screws. There shall be a galv. steel/nylon washer at each end of the damper rod.

10.6.5 Damper blades shall be of same material as duct work but two gauge heavier. Damper blades of 18 gauge and lighter shall have the edges double hemmed. Damper blades larger than 900mm length shall have 'V' crease in middle in which damper rod shall be located.

10.6.6 Dampers of less than 200mm width may be single leaf, 200mm and wider, multi-leaf opposed blade type, or if specified parallel blade type.

Multi leaf damper blades to be interlinked with nylon construction gear wheels at one end to ensure simultaneous smooth movement of all blades. The blades to inter-lock on closure for effective air seal.

10.6.7 Dampers shall have through damper rod with operating lever and lock screw and a quadrant having Open to Close position indicator at one end, damper lever shall be fastened to the rod with set screws. On insulated duct work, quadrants shall be mounted on metal saddles finished flush with insulated surface. The quadrant and lever unit shall be factory fabricated, made of heavy gauge steel electro galvanized, of Engatech manufacture or as approved.

10.6.8 Two position full open-full close dampers (OCD), to be provided where specified or shown on the drawings, shall be of construction as specified above for VCDs except that a quadrant with two position indicator shall be provided for operating the damper.

10.6.9 Splitter dampers shall be installed for air volume adjustment in throats at branch take offs from trunk ducts. Splitter dampers shall be of rigid construction, securely held in adjusted position for operation by means of a rod with damper position indication markings.

10.6.10 Fire dampers shall be installed in all supply air ducts after air handling or air-conditioning units, in return air ducts or wall inlets in AHU or Air-conditioning Unit Rooms, at duct crossings of fire wall partitions of the Building, at ventilation fans discharge, exhaust fans inlet, and at other locations shown in the drawings.

The dampers shall be of heavy gauge steel plate mounted to turn freely in steel plate frame inserted in duct or installed in the wall, proportioned and weighted to close at once if released from link and provided with spring catches to hold closed until manually reset. Dampers and frames shall have suitable eyes and standard fusible links, normally holding them open but releasing upon contact. Ample sized, conveniently located access doors shall be provided for resetting the dampers. Two sets of spare fusible links shall be supplied.

10.6.11 The dampers shall be of Engatech manufacture or as approved.

10.7 FIRE DAMPERS

Fire dampers shall be UL listed. Unless otherwise permitted by the Engineer all curtain-type fire dampers shall be Type B with curtain completely clear of the air stream. Fire dampers shall be installed the manner in which they were twisted and shall meet all applicable codes. Fusible links shall be rated for 100°C unless otherwise damper shall have the same fire rating as the wall in which they are installed Fire dampers installed in duct where air flow may still exist during a fire shall be dynamic type.

10.8 INSTALLATION:

Installation shall ensure that all lines are perpendicular and parallel to the building walls and other surfaces and properly centered so that complete symmetry is obtained.

All diffusers shall be installed directly to the supply air ducting, so that the weight of the diffusers is not transferred to the ceiling. Diffusers shall be so installed that the collar is flush with the ceiling. Gaskets shall be used to prevent leakage.

Registers and grills or duct penetration on sidewalls shall be fixed on GI Sheet 18 Gauge

frames. Frame thickness shall be 3 mm (1/8”) less than the register/grill collar and shall cover the full width of the wall. Perfect alignment and symmetry shall be maintained.

After the system is in operation, if drafts, dead spots, or excessive noise are noticeable in the conditioned areas due to improper selection or construction of the air outlet, the grill/diffuser/register shall be changed to the proper type to remove the defect, without additional cost to the owner.

11.0 SUPPLY AND EXHAUST FANS:

11.1 GENERAL:

The contractor shall supply and install fans of the type and capacity specified in Schedule Sheet and conforming to the specifications given herein. The contractor shall be responsible for the proper selection of the fans so that the specified operating conditions are obtained. Motor shall be sized to provide the required BHP for meeting the specified conditions without overloading. The Fans shall be provided as per List of Approved Manufacturer's.

External static pressure given in the schedule are indicative and for guidance only. The Contractor shall calculate the external and total static pressure for all fans and shall submit the same for Engineer's review and approval before ordering the fans. Required fan and motor shall be provided without any additional cost and no variation or claim shall be entertained in this regard.

11.2 CENTRIFUGAL FANS:

Shall be capable of delivering the specified capacity against the specified static pressure. Scroll shall be fabricated of heavy gauge steel, completely welded for maximum duty and leak proof construction. Fan wheel shall be of aluminum and have backward curved blades, rigidly constructed with non-overloading characteristics, and shall be balanced both statically and dynamically, and shall be free from objectionable noises and vibration. Sealed permanently lubricated, sleeve, roller or ball bearings shall be provided. Spring type vibration isolators shall be provided. Fan shall be provided with 1450 rpm motor with weather proof enclosure, suitable for 400V, 3 phase, 50 Hertz. Fan shall be driven through an adjustable speed belt drive, rated for 1.5 times motor H.P. Fans shall be provided with inlet and outlet flanges/screen. Motor and belt drive shall be provided with a baked enamel finish.

11.3 INSTALLATION:

11.3.1 General: Fans as shown on drawings shall be installed by the Contractor, complete in all respects and as per satisfaction of the DUHS's Engineers. Fans shall be rigidly secured so that they operate without vibration and transmission of vibration to the structure shall be through isolated. Connection to ducting shall be through flexible connectors. Ducting connection to fan shall ensure lowest turbulence and smooth transition of sizes. All supporting arrangements of the fans shall be drawn up by the Contractor and submitted to the Engineer for approval.

Floor mounted fans shall be installed on concrete housekeeping pad at minimum of 100 mm above the floor, fan shall be mounted on vibration isolator. Structural suspended fans shall be installed using threaded rods and vibration isolator.

11.3.2 Commission & Testing: The fans shall be commissioned and tested by the Contractor.

12.0 ELECTRICAL WORKS:

12.1 ELECTRICAL WIRING:

The Contractor shall be responsible for the complete power and control electric wiring of the required of the HVAC and BMS Works and other areas as required for the system. A 3 phase and neutral, 4 wire Electric Supply with earthing continuity conductors where indicated on the drawings will be available for the Contractor. Wiring onwards from this supply point to all motors, controls, etc., shall be the responsibility of the Contractor. The Contractor shall verify the electric power given in motor control center drawings at the time of bidding. No additional cost and no variation or claim shall be entertained if Contractor supplied higher electric power equipment's. For remotely located equipment, a power point shall be supplied near each unit, or where indicated on the drawings and wiring onwards shall be the responsibility of the air-conditioning contractor. The electrification work shall be carried out by a licensed workman, authorized to undertake such a work under the provision of Pakistan Electricity Act and Rules and the latest edition of I.E.E. Wiring Regulations. Any special requirements of the local Electric Supply Company shall be complied with.

12.2 CABLES:

All the cables listed, except otherwise specified, are four cores PVC insulated PVC sheathed cables 600/1000 volts grade as per British Standard B.S. 6004:1969. The conductors shall be of high conductivity annealed copper wires of 99.97% purity heavily insulate with PVC compound and sheathed overall with PVC compound. The insulation color identification will be as red, yellow, blue and black for neutral. In general all the cables, except otherwise specified in the cable schedule will be non-armored types. All cables shall be selected at 45^{o}C. All Power Cable must be from **PAKISTAN CABLE**.

12.3 MOTOR CONTROL CENTER CONSTRUCTION AND COMPONENTS:

(a) General: The central control panel shall be located as indicated in drawings. It shall be floor-mounted, free standing and front access design.

Each piece of equipment on the part shall be identified by a nameplate.

Nameplate may be plastic or metal and attached to the surface of the panel or integral with it.

Painting or lettering, directly on the panel will not be permitted. Control instruments, wiring and terminals shall be within the panel, except that switches pilot lights, and push buttons shall be mounted on the panel front. The front panel shall be hinged for front access. The Motor control centers shall be from Standard manufacturers and shall be provided as per List of Approved Manufacturer's or equivalent make subject to the

approval of DUHS's Engineer.

Cable and breaker sizes and other components of MCC shown in the drawings are indicative and for guidance only. The Contractor shall submit all MCC based on approved equipment's and get approval before ordering. Any change in approved MCC's shall be provided without any additional cost.

(b) Construction: The control center shall be consisted of 90 inches high and approximately 12-18 inches deep. The external panels shall be of flanged 14-gauge sheet steel. Side, top, back and full floor plates shall be rigidly joined by cross members and angle iron brackets.
Removable floor channels 1.5" x 3" shall be provided to support and mount the entire control center.

(c) Unit Compartments: provide each compartment with an individual front door.

(d) Bus: Power shall be distributed horizontally within the control center by a three phase electrolytic imported copper bus (99.7% purity), rated for the required Amperes continuous current and braced for minimum 40,000 ampere RMS asymmetrical short circuit current or as indicated on drawings. The bus shall be efficiently isolated from all wiring troughs and other working areas. Power within vertical sections shall be distributed by vertical copper bus bars. Bus bars shall be painted red, yellow and blue.
All the bus bars, internal wiring cables and other equipment shall be rated for 45^{o}C ambient and bus bar end temperature of 65^{o}C.
Provide copper ground bus of the required amperage but having not less than 200 amperes capacity in the base of the control center permanently grounding the structure. Provide lugs as required for ground wire attachment.

(e) Incoming & Outgoing Cable Termination: Provide 12" or more of wiring space just below the main bus for incoming cable. Provide space for outgoing cables through either top or bottom of all standard vertical sections.

(f) Main Protective Device: The incoming line protection device unless otherwise specified shall be a circuit breaker of the frame size and ampere rating required for the power supply to the plant.

(g) Motor Starters: All starters for single phased motors shall be automatic magnet direct-on-line types with adjustable overload cutout start/reset push button. Where electrical interlocking is required the starters shall be additionally provided with hand/off/auto switch and at least two auxiliary contacts for electric or electronic interlocking or as specified.
All three phase motor starters up to 7.5 HP shall be automatic magnetic direct-on-line type, with three adjustable overload cut-outs, Ammeter low voltage cut-out, single phasing preventer, stop-reset push button, HAND-OFF-AUTO switch and at least one auxiliary contact for electrical interlocking circuit or as specified.
The squirrel cage induction motors above 7.5 HP shall have star-delta type reduced voltage starters. The automatic starter shall have hand/off/auto switch, wherever electrical interlocking is required or where shown on the drawings. All starters should

have three adjustable overload cutouts, Ammeter low voltage cutout, single phasing preventer, stop-reset push button, at least two auxiliary contacts for electrical interlocking circuit.

All starters control circuit and magnetic coils to be suitable for 220 volt, 1 phase A.C. For motors requiring electrical interlocking or remote control or sequence starting control or any other such feature, starters should have necessary auxiliary contacts providing the desired control arrangement.

A separate set of terminals is required for each control circuit. All motors and starters provided under this contract should be of one manufacturer except for the equipment where special motors and starters are provided as standard components.

(h) Unit Nameplate: Each unit shall be identified by a ½" x 4" engraved nameplate.

(i) Motor Protection: Furnish and install all starters, overload heaters, as well as fuses unless specifically noted otherwise on the drawings. The selection of the overload heaters shall be based on the motor nameplate data. Fuses shall be of the dual element type, unless specifically noted otherwise. They shall be properly coordinated and in general sized according to fuse manufacturer's recommendations for the loads served.

(j) Air Break Contractors: The contractors shall be suitably rated according to the motor output rating if not specified in the drawings and having rupturing capacity of 25 kA. Backup fuses to be provided if rupturing capacity is lower than the required.

The contractors should have sturdy magnets and bearings and should have bouncing, easily replaceable contacts of silver alloy and long contact life.

(k) Time Relays: Time relays used in Automatic star-delta starter can be motor driven or electronic type but should have a high timing accuracy independent of voltage and temperature fluctuations.

The relays should generally have operating time range between 0.5 to 20 seconds. However in cases of motors having longer starting periods the Contractor will check their starting time and use matched time relays accordingly.

(l) Selector Switches, Pilot Lamps, Relays, etc.: In general, where motors are to be automatically controlled a "HAND-OFF-AUTO" selector switch shall be provided and mounted in the enclosure cover. Selector switches shall be equipped with Voltmeter and Ammeter. Provide motors that are to be started manually with "START-STOP' buttons mounted in the enclosure cover.

For all motors installed in the plant room, pilot lights, for ON-OFF-OVERLOAD status indication shall be provided on this panel, or specifically as shown on drawings.

Necessary relays etc. for interlocking starters, LEAD-LAG Switch, etc., shall also be provided.

The overload relays shall be of the soldered ratchet type.

Starters used on 400 volts circuits shall have a 220 volt step-down control transformer included in the enclosure of 350 volt amperes.

Provide each starter with a blank plastic nameplate with the equipment identification marked thereon.

12.4 MOTOR CONTROL CENTER CONFIGURATIONS:

Motor control centers shall have the configuration as shown on the drawings.

12.5 CABLE TRAYS:

The cable tray system shall be of one manufacturer and shall include factory made trays, tray fittings, connections and necessary accessories and supports to form a complete tray support system.

The cable tray system shall include the following factory made tray elements. Straight trays and ladders, fittings and horizontal and vertical bends of various angle crosses, tees, wyes, reducers, vertical riser elements, connectors and all necessary fixing accessories.

Cable trays shall be constructed from mild steel of minimum thickness 16 gauge (1.5 mm). Trays in excess of 300 mm width shall be of minimum thickness 14 gauge (2.0mm).

Insert elements, bolts, screws, pins etc., shall be mild steel cadmium plated.

a. Tray work shall have oval perforations. Ladder type trays shall be used as required and/or approved by the Engineer.
b. All trays (straight and fittings) to be heavy duty returned flanged type unless specified otherwise.
c. Tray component are to be accurately rolled or formed to close tolerance and all edges rounded. Flanges are to have full round smooth edges.
d. Ladder racks of widths up to and including 300mm shall be constructed from rolled steel sections of minimum thickness 16 gauge (1.5 mm). Ladders in excess of 300 mm width shall be C Section construction with a minimum thickness of 14 gauge (2.0mm). the rungs shall be spaced at a maximum 300 mm.
e. Unless indicated otherwise on drawings, cable trays shall be used in the range 150 mm to 900 mm wide, in fire preferred standard sizes: 150, 300, 450, 600 and 900 mm.
f. Other sizes shall be used where specified or previously agreed with the Engineer.
g. Flanges shall be a minimum of 50 mm deep.
h. Minimum radius at side rails, horizontal and vertical tees and crosses shall be in accordance with the Manufacturer's standard.

Perforated, heavy duty, return flange type, in 2.5m nominal lengths Hot dip galvanized after completion of bending and drilling, complete with all necessary purpose made bends, tees, supports and the like. Width shall be such as to permit adequate access for installation and maintenance of cables and per the requirements of KE regulations.

12.6 INSTALLATION:

12.6.1 General:

The Contractor shall be responsible for the complete power and control electric wiring of the HVAC and BMS Works. A 3 phase and neutral, 4 wire Electric Supply with earthing continuity conductors where indicated on the drawings will be available for the Contractor.

Wiring onwards from this supply point to all motors, controls, etc., shall be the responsibility of the Contractor.

12.6.2 Electric Wiring & Earthing:

The electrification work shall be carried out by a Licensed Electrician, authorized to undertake such work under the provision of Pakistan Electricity Act & Rules. The installation shall be carried out in conformity with Pakistan Electricity Act & Rules and the latest edition of I.E.E. Wiring Regulations. Any special requirements of the local Electricity Supply Company shall be complied with.

All power and control wiring shall be duly tagged/ numbered on circuit for the ease of trouble shooting on wiring diagram and on circuits in MCC. All wiring in Plant Room shall be run in approval rigid and flexible steel conduits from the MCC to the motors, on the surface of walls, roofs & columns. Galvanized steel saddle and clamps of minimum16 SWG, approved by the DUHS's Engineers, shall be fixed to the surface using nylon plugs and galvanized steel screw, with a maximum distance of 3 ft. between clamps. Pull boxes, having sized of 4' x 4" & 2" deep and constructed of 18 SWG sheet steel shall be installed wherever required to limit the pulling length and shall be in a flexible steel conduit, provided with suitable bras glands and check nuts.

Earthing continuity conductors shall be hard drawn base electrolytic copper wires of the recommended size for the motor being served and shall be run along the cables. Earthing to each motor of 1 HP and above shall be with 2 conductors. The minimum size for the earthing shall be 10 SWG.

12.6.3 Steel and G.I Conduit

The minimum size of conduit shall be 20 mm.

The use of solid or inspection elbows, bends or tees will not be permitted and 120 degree bends shall be limited to one between any two drawn-in boxes. Conduit coupling joint shall not be used where conduit enter spout entry boxes. Conduit running, joints shall not be used where conduit enter conduit boxes or spout entry boxes.

Equipment that is required to be removed for maintenance shall be provided with conduit unions in all conduits that enter such equipment. The use of conduit nipples shall be avoided as far as practicable.

All conduits shall be cut square and reamed at the end. All conduit ends and the inside of conduits shall be clean and free from burrs.

Where bushed spouts or tapped holes are not provided at conduit termination, the conduit shall be terminated in a flanged socket and a smooth bore brass hexagon bush, with a lead washer fitted between the flanged socket and the equipment or box.

All exposed threads and parts where the galvanizing has become damaged shall be thoroughly cleaned and painted with galvanized paint. the exposed conduit ends shall be capped to protect threads from being damaged before installing cables.

Repair painting shall take place before any making good on site or buildings is carried out. The entire conduit system shall be checked for continuity. Any observation found shall be removed

without damaging the installation.

The conduit system shall be installed empty with a 16 SWG steel wire drawn through the conduits for pulling of cables. Joints in underground conduits shall be avoided or reduced to the absolute minimum.

Where adjustable dies are used they shall be so adjusted that threads cut with them shall be the same depths as machine made threads.

The use of manufactured bends shall be avoided and instead smooth bends shall be provided by using approved type of bending tools.

Flexible steel conduits shall be installed at all points locations where flexible connection is required, as directed by the Engineer. The flexible conduits when used, shall be protected by external PVC sheath, resistant to oil damages.

G.I. pipes for underground installation shall be given bituminous paint coating and wrapped with suitable paper or cloth before installation.

12.6.4 Testing:

(a) General: Upon completion of installation and carrying out physical inspection of works, the Contractor shall perform field tests on all equipment and material before commissioning. All tests shall be performed in the presence of the DUHS's Engineer's and client representatives for the purpose of demonstrating the equipment or system compliance with specifications, and that each component shall electrically and mechanically function properly as intended. In general, the tests shall be carried out in accordance with Section 'E' of Regulations for the Electrical Equipment of Buildings. The Contractor shall however insure that the requirements of the Local Electrical Inspector are met with, and the installation is duly approved by the Electrical Inspector. Proper regards to manufacturer's instructions for testing procedures shall be given for equipment.

The Contractor shall furnish, install and maintain all tools, instruments, test equipment, material, etc., including all personnel required for carrying out the setting, adjustment and recording associated with the testing procedures. All tests shall be made with due consideration to the protection of installation and personnel carrying out the tests. Adequately qualified and trained staff shall supervise the tests. The procedure and sequence of testing shall be furnished to the DUHS's Engineer at least 48 hours before starting of tests. The Contractor shall systematically keep a record of results of all tests carried out. Two copies of all test data and complied results duly initialed by Engineer Incharge/Authorized Representative present during the tests shall be supplied to the DUHS's Engineer for record purposes and approval obtained.

(b) Insulation Resistance Test: Insulation Resistance tests shall be carried out on all electrical equipment and wiring, using a self-contained instrument such as direct indicating Ohmmeter of generator type. Only direct current potential shall be used for such testing; voltage range for the same areas under:

Circuits up to 250 volts: 500 volts D.C.

Circuits above 250 volts

and up to 500 volts: 1000 volts D.C.

All cables before connection at switchgear of equipment shall be tested for insulation resistance. The test shall be carried out individually between each cable in circuit and also between cable and earth. The minimum acceptable value of insulation resistance shall be 1 Megomh.

Before making any connection all switchgear shall be tested for insulation resistance between live parts and earth. Insulation tests on circuit breakers between each phase and earth. The minimum acceptable value of insulation shall be 5 Meg. Ohms. If the Insulation resistance of any circuit or equipment under test is less than the specified values, the cause of low reading shall be determined and necessary corrective measures carried out. Tests shall be repeated after rectification of defective section for ensuring correct value of insulation resistance before commissioning.

(c) Operational Tests:

All equipment power feeders shall be tested for operation under load conditions.

Each switch shall be carried to ensure that the operating mechanisms are working. Nameplates are also to be checked for proper designation with respect to the equipment connected. The Contractor shall identify the phases of incoming supply and all equipment, to ascertain that each circuit is connected in proper phase sequence. Wherever required phase identification markings or labelling shall be provided on switchgear and cables. Motors must be tested for proper rotation and stroboscopic effect.

13. SYSTEM AUTOMATIC CONTROLS.

A factory trained Engineer duly authorized by the automatic controls manufacturer alongwith skilled help shall commission, calibrate, adjust and set all automatic control systems till the specified requirements are achieved to the satisfaction of the DUHS's Engineer. The authorized Engineer shall give instructions at site to the Employer's operating personnel for operation and maintenance of the automatic controls for a period of atleast two weeks. The safety controls shall also be adjusted and set to meet the requirements specified by the equipment manufacturers.

13.1 The Contractor shall depute experienced Engineer(s) and skilled help well familiar with the nature of the work and provide all instruments etc. required for testing, balancing and adjustment of equipment and automatic and safety controls.

13.2 The testing, adjusting and proper setting of the various systems, automatic and safety controls as specified above and as required to ensure that the plants meet the specified performance requirements, are an essential part of the works and the Engineer/DUHS's Engineer will check and test the plants performance after the same have been completed by the Contractor.

13.3 The works shall not be considered as completed till the requirements specified above have been complied with to the satisfaction of the Engineer.

13.4 All control cable must be by **BELDEN-USA** make.

14 INSTRUMENTS

14.1 The Contractor shall supply and install all necessary indicating thermometers, pressure gauges etc. for easy checking of operation of the complete plant. Amongst others, the

following instruments and measuring points shall be included but duplication of instruments and points is to be avoided. The selected scale range of instruments shall suit the anticipated operational range. The suggested ranges are $10\text{-}35^0$, $0\text{-}50^0$, $0\text{-}70^0$, $0\text{-}100^0$ and $0\text{-}200^0$C for thermometers and 990m Bar vacuum - 2Bar, 0-4, 0-7, 0-10 and 0-20 Bar for pressure gauges.

14.2 Insertion type duct mounted 75mm dia dial thermometer shall be provided in each return air inlet and on the leaving side of each cooling and heating coil of air handling units, fresh air inlet and supply air of zones.

14.3 Industrial type pipe insertion thermometers atleast 100mm dia dial scale with external recalibration or 230mm long stem scale, separable copper wells and sockets with extension neck for insulated piping, shall be provided at each water inlet and outlet of water chiller/heater, condenser, absorber, hot water boiler, heat exchanger, cooling coil, heating coil and pumps. Where only thermometer wells have been shown in the drawings only these shall be supplied.

14.4 Compound/pressure gauges, atleast 100mm diameter with Bourdon tube type element and internal mechanism with individual bearings to give best accuracy under fluctuating pressure and vibrations shall be provided at suction and discharge of all water pumps, inlet and outlet of water chiller/heater, condenser, absorber, hot water boiler, heat exchanger and cooling coil and heating coil. Where only gauge cocks have been shown in the drawings, only these shall be supplied.

14.5 At the chilled/hot water supply and return branch take-off from the main piping, a thermometer copper well and pressure gauge connection with cock, and a pressure gauge connection with cock across each pressure reducing valve should be provided so that when required the Operator can install thermometers and gauges for taking readings. The gauge connection shall further be capped.

14.6 Inclined scale manometers of 0-25mm,0-50mm or 0-75mm Wg scale range shall be installed across each air filter bank.

14.7 The gauge cocks shall be of brass with lever handle and for steam gauges, a siphon filled with water shall be installed between the cock and gauge to prevent steam from entering the Bourdon tube.

14.8 The instruments shall be Ashton/Ashcroft/Negretti and Zambara/ Taylor/Weksler manufacture or approved equal.

14.9 The tenderer to give complete details of all the instruments offered by him.

15.0 CLEANING, TESTING, BALANCING AND TEST DATA:

15.1 GENERAL:

a) The entire testing balancing and adjusting process to be thoroughly organized & planned. All activities, including the organization, procurement of required test instrumentation and the actual system should be scheduled as soon as practical after the installation has been completed.

b) The contractor shall appoint an independent agency specialized in the testing & balancing of HVAC systems as a third party and their appointment must be subjected to DUHS's Engineer's and client approval.

c) Testing and balancing shall be performed in accordance with NEBB (National Environmental Balancing Bureau) USA, code of practices and all final reports shall be signed and certified by the agency appointed to perform such works.

d) The TBA agency must carry out the preparatory works which shall include the planning and scheduling of all TBA procedures, collecting the necessary data, reviewing the data collected, studying the system to be balanced, recording the published data on the test report forms, and finally, making preliminary field checks of the HVAC equipment and systems.

e) The contractor shall submit six copies of the complete test procedure to the engineer for approval one month prior to the date of commencement of the balancing and performance test.

15.2 CLEANING AND ADJUSTING:

Pipe shall be cleaned free of scale and thoroughly flushed of all foreign matter. Temporary bypass shall be provided for all water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned of all debris and blown free of all small particles of rubbish and dust before installation of outer faces. Equipment shall be wiped clean, with all traces of oil, dust or paint spots removed. Temporary filters shall be provided for all fans that are operated during construction, and after all construction dirt has been removed from the building, new filters will be installed.

Bearings shall be properly lubricated with oil or grease as per recommendations of the manufacturer. Belts shall be tightened to proper tension. All control valves and other miscellaneous equipment, are requiring adjustment shall be adjusted for setting indicated or directed. Fans shall be adjusted to speed indicated by the manufacturer to meet the specified conditions.

15.3 TESTING:

(a) Piping: After cleaning, water and steam piping shall be hydrostatically tested at a pressure equal to 150% of the maximum operating pressure for a period of time sufficient to inspect every joint in the system and in no case less than four hours. No loss of pressure will be allowed. Leaks found during tests shall be repaired by re-welding or replacing pipe or fittings. Caulking of joints will not be permitted. Concealed piping shall be tested in place before concealing. Tests shall be conducted in the presence of the DUHS's Engineer or the DUHS's Engineer's representative who shall be given 10 days' notice before any test is to be conducted. Water and electricity required for the test shall be furnished by the Owner. Any material, equipment or instruments required for tests shall be provided by the Contractor.

b) Duct Work: Ducts, plenums and casings shall be tested and made substantially air tight at static pressure indicated for the system before covering with insulation or concealing

in the masonry. The term substantially airtight shall be constructed to mean that no air leakage is noticeable through the senses of feeling or hearing.

15.4 BALANCING:

(a) Duct system shall be balanced to produce air quantities within 5% of that indicated.

15.5 PERFORMANCE TESTS:

After cleaning, balancing, and testing operations have been completed, as herein before specified, the system shall be tested as a whole to see that all items perform as an integral part of the system, and that temperature and conditions are evenly controlled throughout the building. Corrections and adjustments shall be made as necessary to produce the conditions indicated, at no additional cost to the Owner.

15.6 TEST DATA:

General: The Contractor shall provide the DUHS's Engineer with typewritten schedules of readings taken during the balancing and testing operation for the following items:

15.6.1 AIR BALANCE:

(a) Fans: Size, type, speed in revolutions per minute, static pressure in inches of water, air quantity in cubic feet per minute, and motor load in amperes and voltage.

(b) Coils: Size, face velocity in feet per minute, air-condition on-and-off Uni.-wet-bulb and dry-bulb temperature in ^{o}F., water temperature drop through heating/cooling coil, temperatures entering coil in ^{o}F.

(c) Ducts: Size, velocity in feet per minute, and air quantity in cubic feet per minute.

(d) Air Outlets and Inlets: Size, velocity in feet per minute, and air quantity in cubic feet per minute.

15.6 CONTROL SETTING:

The actual on site setting of all automatic controls including thermostats, safety controls, minimum damper settings, fan safety thermostats, pressure controls, temperature and humidity controls and other similar items shall be provided in the form of a tabulated list indicating type of control, location, setting and function.

15.7 OTHER EQUIPMENT:

The contractor shall also provide written data on the performance of any other equipment; in the form and manner and giving all information required by the DUHS's Engineer/Engineer. The Contractor shall also submit a certificate along with all test reports submitted, certifying that all test have been carried out by component engineers, and that all data submitted has been verified and found to be correct.

15.8 TEST PROCEDURES:

The contractor shall be responsible to follow the test procedure as under

1. Preliminary inspection & tests.
2. Balancing and commissioning.
3. Performance tests
4. Reliability trail test.

16.0 PAINTING AND FINISHING:

16.1 GENERAL:

Painting shall include furnishing labour, materials, equipment, ladders, scaffolding, protective covers, other items required to prepare and finish surfaces of work specified herein or in any other sections.

Paint shall be applied as per manufacturer's printed application directions. Paint color schemes shall be specified at the time of painting or earlier.

Paint shall be applied to the following:

(a) Materials and Equipment: All materials and equipment factory fabricated, imported or otherwise shall be provided with a fresh coat of paint, of same color as the original factory-paint. Unless otherwise directed by the DUHS's Engineer. The items covered under this head shall include chillers, air handling units, fan coil units, pumps, Cooling tower, fans, etc.

(b) Piping and Pipe fittings and valves etc. shall be provided with two coats of red lead from an approved manufacturer. Chilled water piping shall be further provided with two finish coats. All valves etc. shall be painted in a color, different from the color on the adjacent pipe. Apply two coats of asphalt paint to all pipes laid in concrete or passing through concrete.

(c) Hangers and Supports shall be provided with two coats of red iron from an approved manufacturer. All hangers and supports exposed to view shall be further providing with two coats of finish paint of an approved color.

All new surfaces to be painted are prepared properly to receive prime coat of paint. Surfaces shall be scraped or wire-brushed to remove mill scale, rust and clean with solvent of remove grease, oil and dirt. All surfaces shall be thoroughly dried before application of paint. Prime coat shall be suitable for subsequently applied finish coats. For prime coat red lead paint of an approved manufacturer shall be used, such as 'KROMIC' Synthetic Red Lead by Johnson & Nicholson shall be used.

Before finish coat is applied to all prime coated surfaces shall be properly touched up. The equipment and piping shall not be finished painted until they have been tested and approved. All succeeding coats shall be applied only when the undercoats are thoroughly dried.

For piping system identification a color scheme based on American Standard "Scheme for identification of Piping System", "ASA A-13.1-1975" shall be specified and get approved by the DUHS's Engineer and then this color scheme shall be used to finish painting.

16.2 STENCILING:

The Contractor shall stencil near each valve on the pipe, the name of the fluid. Also an arrow should be painted next to the legend indicating the direction of flow in pipe. The stencil legend shall be placed in a location so that it can easily be read from the floor.

16.3 IDENTIFICATION TAGS:

Shall be installed on valves, controls and other parts of the system where directed to do so. Tags shall be polished or lacquered brass 40 mm round, or octagonal with stamped letters or numbers, 12 mm high, filled with black paint and fastened securely with brass "S" hooks or chains.

The Contractor shall further provide charts, diagrams, of size and type as approved designating number, service or function and location of each tagged item.

16.4 PIPING AND DUCT WORK IDENTIFICATION:

1. After completion of insulation and /or painting, all piping and ductwork exposed or concealed shall be marked in English to show the services name and direction of flow.
2. Marking shall be placed at each side of any wall, partition or floor, at 10m intervals on all exposed piping and ductwork and at each access panel or door. Marking shall be located so as to be in full view.
3. Marking shall be stenciled. Use black stencil on light colored surfaces, yellow stencils on dark colored surface except where fire lines which shall be stenciled in accordance with civil defence requirements. Stencils shall have distinct edges. Blurred stencils are not acceptable. The name of the services shall be stenciled fully or with abbreviations standard to the industry. Non standard abbreviations are not acceptable. Letters shall be a minimum of 50mm high for ducts and for pipes 75mm or larger to outside of insulation. Letters for smaller pipes shall be 20mm high. All markings shall be clearly legible from 1.5m above the adjacent floor or platform.

17.0 OPERATING AND MAINTENANCE INSTRUCTIONS:

17.1 BOUND INSTRUCTIONS:

Six complete sets of operating and maintenance manuals, duly approved by the DUHS's Engineer, shall be supplied by the Contractor, prior to hand over of the project to the owner. Each set shall be permanently bound and shall have a hard cover. Each manual shall be inscribed with suitable legend for proper identification and use of the manual. The matter shall be legibly typed and/or shall be clear Photostat copies of the original documents, catalogues, etc. Flysheets shall be placed before instructions covering each subject. The instruction sheets shall be

approximately 8 ½" x 11", with large sheets of drawings folded in. The manual shall be arranged in two parts, and shall generally conform to the arrangement shown below.

Part I – Systems

1. The system volumes shall be organized into divisions wherein each division represents a generic function. System shall then be classified under appropriate divisions.

2. The material for each system shall then be organize in sections descriptive of the following basic areas of information:
   (a) Descriptive Information
   (b) Operating Instructions
   (c) Inspection and maintenance instructions.

3. Sections shall be organized to include the following categories of information:
   (a) Descriptive Information:

      (1) Function of service.
      (2) Classification.
      (3) Design Capability.
      (4) Performance characteristics.
      (5) Principal components.
      (6) Distribution arrangement.
      (7) Schematic diagram.
      (8) Control diagram.
      (9) Equipment data:
         (a) Inventory designation.
         (b) Manufacturer and Model.
         (c) Size and rating.
         (d) Pressure, speed, and temperature limitations.

   (b) Operating Instructions:
      (1) Starting and stopping procedures.
      (2) Adjustment and regulation.
      (3) Seasonal changeover.
      (4) Seasonal start-up.
      (5) Seasonal shutdown.
      (6) Logs and records.

   (c) Inspection and Maintenance:
      (1) Inspection schedule & checklist.
      (2) Schedules and procedures for lubrication, adjustment, cleaning, painting, protection and testing.
      (3) Inspection and maintenance record.

4. Reference Documents.

   (a) Construction drawing list.
   (b) Construction Specifications.
   (c) As-built record drawings.
   (d) Test and balance records.

Part II – Equipment

1. This part of the manual shall be composed of manufacturer's data on equipment and materials organized into divisions wherein each division represents generic classification of equipment, such as:

Division Title	
Air-conditioning & Ventilation.	1
Controls.	2
Instruments & Accessories	3
Motors	4
Refrigeration	5
Starters	6
Fans	7

2. Each division shall be organized in sections wherein each section would represent a specific type of equipment. For example, for Division 1 the sections shall generally include the following:

Air Conditioning & Ventilating	1.0
Coils cooling	1.1
Fans	1.2
Centrifugal	1.3
Filters roughing	1.4
Terminal	1.5
Duct.	1.6
Other equipment	1.7

3. Coverage of section. Each section shall include the following manufacturer information:
   - (a) Descriptive literature
     - (1) Catalogue cuts, brochures, or shop drawings.
     - (2) Dimensional drawings.
     - (3) Materials of constructions.
     - (4) Parts designations.
   - (b) Operating characteristics:
     - (1) Performance tables and charts.
     - (2) Performance curves.
     - (3) Pressure, temperature and speed limitations.
     - (4) Safety devices.
   - (c) Operating Instructions:
     - (1) Prestart checklist.
     - (2) Start-up procedures.
     - (3) Inspection during operation.
     - (4) Adjustment and regulations.
     - (5) Testing.
     - (6) Detection of malfunction.
     - (7) Precautions.

(d) Inspection Instructions and procedures:

(1) Normal and abnormal operating temperature, pressures and speed limits.
(2) Schedule and manner of operation.
(3) Detection signals.

(e) Maintenance Instructions and Procedures

(1) Schedule of routine maintenance.
(2) Procedures.
(3) Troubleshooting chart.

(f) Parts List.

(g) Spare parts.

(1) Essential inventory.
(2) Distributor Directory.

(h) Service Contracts.

17.2 FRAMED INSTRUCTIONS:

Approved wiring and control diagrams showing the complete layout of the entire system, including equipment, piping, valves and control sequence, framed under glass or in approved laminated plastic, shall be posted, wherever directed. In addition, condensed operating instructions, explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. Proposed diagrams, instructions, and other sheets shall be submitted for approval prior to posting. The framed instructions shall be posted before acceptance testing of the system.

17.3 FIELD INSTRUCTIONS:

Upon completion of the work and at a time designated, the services of one or more project engineers shall be provided by the Contractor for a period of not less than 60 days to instruct representatives of the Owner in the operation and maintenance of the Air-conditioning system. The field instructions shall cover all the items contained in the bound instructions.

18.0 TEST RUNS

18.1 The Contractor shall be required to carry out test run(s) as specified in the Memorandum of Tender after the issue of the Certificate of Substantial Completion for the complete works by the Engineer. The period for the test run(s) would be designated in writing by the Engineer. The test run observations shall be recorded in duplicate by the Contractor on printed log sheets approved by the Consultant. The Contractor shall depute an experienced Site Engineer and sufficient skilled labour for taking and recording test run observations. The normal plant operation shall be carried out by the Employer's Operators.

18.2 The Employer shall only provide without charge to the Contractor water, electricity and fuel for the test run(s) and the Contractor shall be responsible for the supply of all tools and instruments etc. required to take and record the test run observations.

18.3 The log sheets shall be jointly signed by the Employer's Representative and Contractor's Site Engineer. The Contractor shall hand over one set of log sheets to the Employer's Representative every day.

18.4 The Contractor's Project Engineer shall check and prepare a summary of observations on printed forms approved by the Consultant in quadruplicate at the end of each test run week. One set each shall be supplied to the Engineer, Consultant and Employer's Representative within one week of the conclusion of the corresponding test run week.

18.5 The Engineer shall check the performance of the plant(s) during the test run(s). If the plant(s) performance meets the specified requirements, the Engineer shall issue a Certificate of satisfactory completion of test run(s) to the Contractor.

19.0 MAINTENANCE

19.1 The Contractor shall be responsible without additional charge to the Employer for maintenance and servicing of the complete plant during the period of maintenance named in the Memorandum after the issue of the Certificate of Substantial Completion by the Engineer.

19.2 The Contractor shall be responsible for arranging all tools, instruments and Technical Staff including Specialist Technicians/Engineers required for the work. The Employer shall be responsible to supply all materials and spare parts required for the work excluding parts defective due to manufacturing defect which shall be replaced by the Contractor under the terms of the contract.

19.3 The Contractor shall service the complete plant regularly according to the Schedule of Servicing and Maintenance as approved or amended by the Consultant but not less than once a month during the operational seasons. The servicing and maintenance shall be carried out by competent skilled labour under supervision of a qualified Engineer. The Contractor shall take a certificate of satisfactory completion of monthly servicing from the Employer's Representative.

19.4 The Contractor shall carry out annual servicing, maintenance and overhauling of the complete plant at the end of the operational season and make the plant ready for operation in all respects well before the commencement of the next operational season. On receiving notification from the Contractor that annual servicing, etc. is nearing completion, the Consultant shall check the work carried out and give directions to the Contractor for completion of outstanding work, if any.

19.5 On satisfactory completion of annual servicing, maintenance and overhauling of the complete plant, the Engineer shall issue a Certificate of satisfactory completion to the Contractor.

PLASMA COLLECTION AND PROCESSING LABORATORY HVAC WORKS

(TENDER DRAWINGS)

Drawing No.	TITLE
A/C0322-H000	TITLE SHEET
A/C0322-H100	LIST OF DRAWINGS
A/C0322-H101	ROOM DATA SUMMARY SHEET HVAC
A/C0322-H102	AREA LAYOUT
A/C0322-H103	AREA CLASSIFICATION
A/C0322-H104	AIRFLOW DIRECTION/PRESSURES
A/C0322-H105	HVAC ZONNING
A/C0322-H106	AIR SCHEMATIC ZONE-01 (MICRO LAB)
A/C0322-H107	AIR SCHEMATIC ZONE-02 (QC-LABS)
A/C0322-H108	AIR SCHEMATIC ZONE-03 (GOWN/DE-GOWN)
A/C0322-H109	AIR SCHEMATIC ZONE-04 (PLASMA PROCESS/SEPARATION)
A/C0322-H110	AIR SCHEMATIC ZONE-05 (BLOOD COLLECTION)
A/C0322-H111	AIR SCHEMATIC ZONE-06 (PLASMA STORAGE AREA)
A/C0322-H112	HVAC REFLECTED CEILING PLAN
A/C0322-H113	HVAC LAYOUT GROUND FLOOR
A/C0322-H114	HVAC LAYOUT FIRST FLOOR TECHNICAL FLOOR
A/C0322-H115	HVAC LAYOUT AT ROOF
A/C0322-H116	AHU SCHEDULE OPERATING CONDITIONS
A/C0322-H117	HEPA HOUSING DETAIL
A/C0322-H118	ELECTRICAL SINGLE LINE DIAGRAM
A/C0322-H119	DIRECT DIGITAL CONTROLS
A/C0322-H120	HVAC MISCELLANEOUS DETAIL

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PROJECT

PLASMA COLLECTION AND PROCESSING LABORATORY

Mechanical Consultant

Approved By	RIZWAN	Sheet No.
Checked By	RIZWAN	DRAWING NO. A/C0322-H100
Drawn By	WARIS	
Scale	3/16"=1'-0" ON A3	REVISION NO. 0
Date March-2022	LIST OF HVAC DRAWINGS	

ROOM DATA SUMMARY SHEET

ROOM NUMBER	ROOM NAME	AREA	AREA CLASSIFICATION	TERMINAL H13	BANK H13	TEMPERATURE	RELATIVE HUMIDITY	MINIMUM AIR CHANGES PER HOUR
		SQUARE FEET	-			°C	RH %±15%	No.
1	MICRO LAB	152	10,000	YES	YES	23	50	60
2	BUFFER MICRO LAB	25	10,000	YES	YES	23	50	60
3	QC-1 WET LAB	175	100,000	NO	YES	23	50	20
4	QC-2 WET LAB	226	100,000	NO	YES	23	50	20
5	PASSAGE LABS	51	100,000	NO	YES	23	50	20
6	QC OFFICE	39	100,000	NO	YES	23	50	20
7	NETWORK ROOM	39	100,000	NO	YES	23	50	20
8	CORRIDOR	85	100,000	NO	YES	23	50	20
9	PLASMA STORAGE AREA	95	100,000	NO	YES	23	50	20
10	PLASMA SEPARATION AREA	63	10,000	YES	YES	23	50	60
11	PLASMA PROCESSING LAB	234	10,000	YES	YES	23	50	60
12	BUFFER PLASMA PROCESS	25	10,000	YES	YES	23	50	60
13	GOWN/DE-GOWN PLASMA LAB	95	100,000	NO	YES	23	50	20
14	ENTRANCE PLASMA	27	100,000	NO	YES	23	50	20
15	OFFICE PLASMA	44	UNCLASSIFIED	NO	NO	23	50	-
16	BUFFER BC	34	100,000	YES	YES	23	50	20
17	CHANGE ROOM BC	29	100,000	YES	YES	23	50	20
18	BLOOD COLLECTION	67	100,000	YES	YES	23	50	20
19	HORSE RESTRAIN AREA	210	-	-	-	Not Applicable	-	-

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PLASMA COLLECTION AND PROCESSING LABORATORY

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Approved By	RIZWAN	Sheet No.
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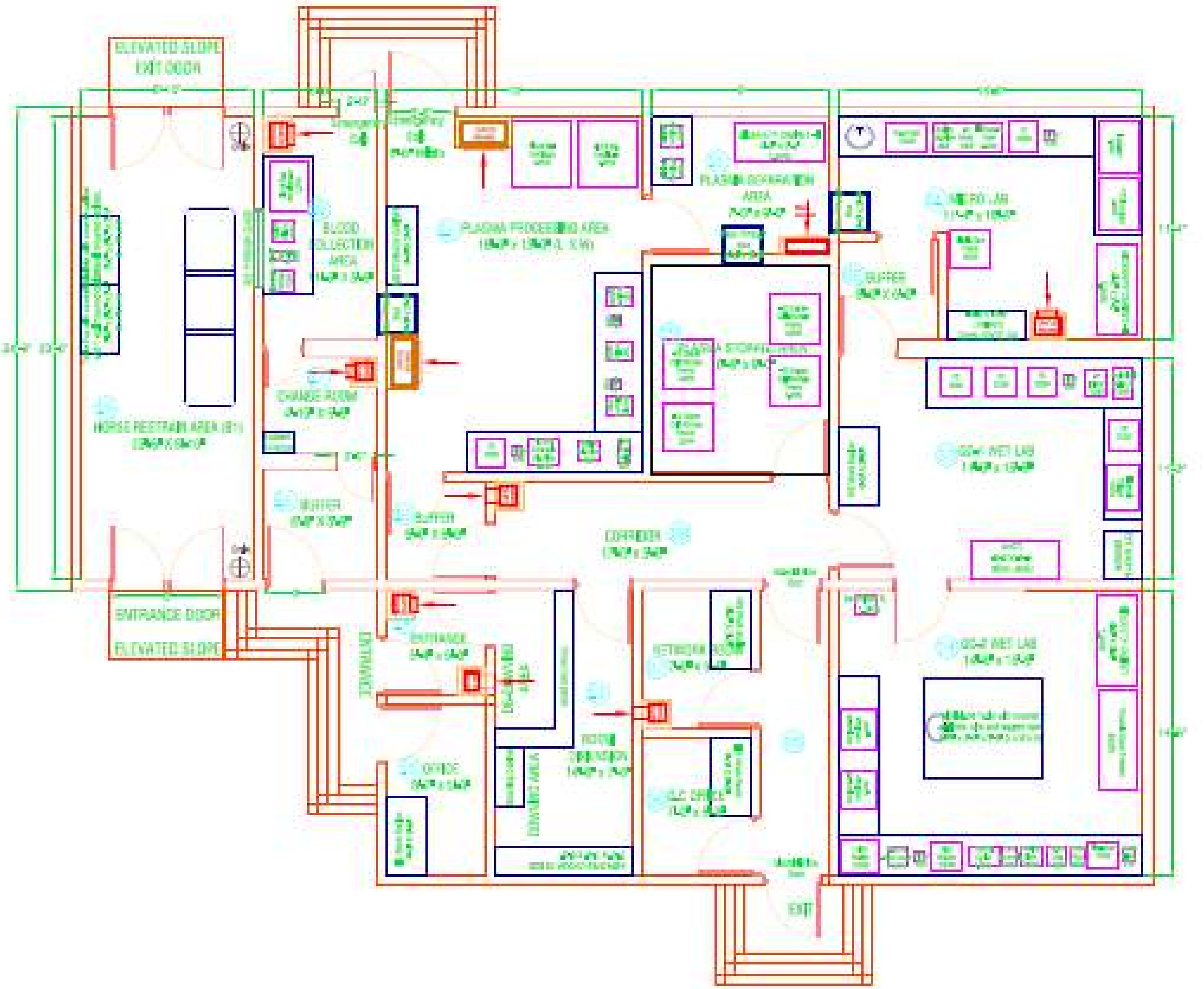
Drawn By	WARIS	
Scale	3/16"=1'-0" ☐ A3	REVISION NO. 0
Date March-2022	ROOM DATA SUMMARY SHEET HVAC	



PLASMA COLLECTION AND PROCESSING LABORATORY

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PLASMA COLLECTION AND PROCESSING LABORATORY

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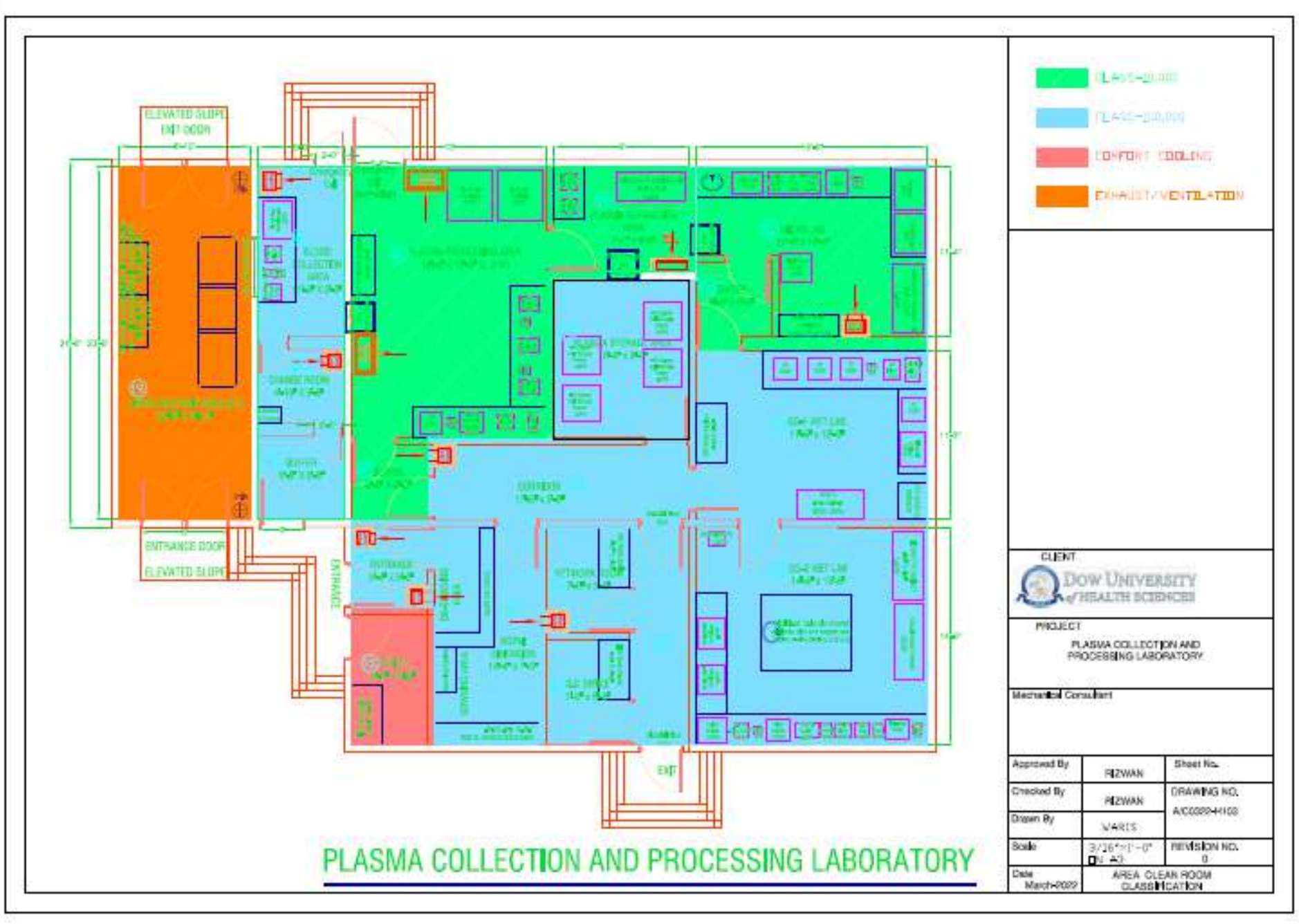
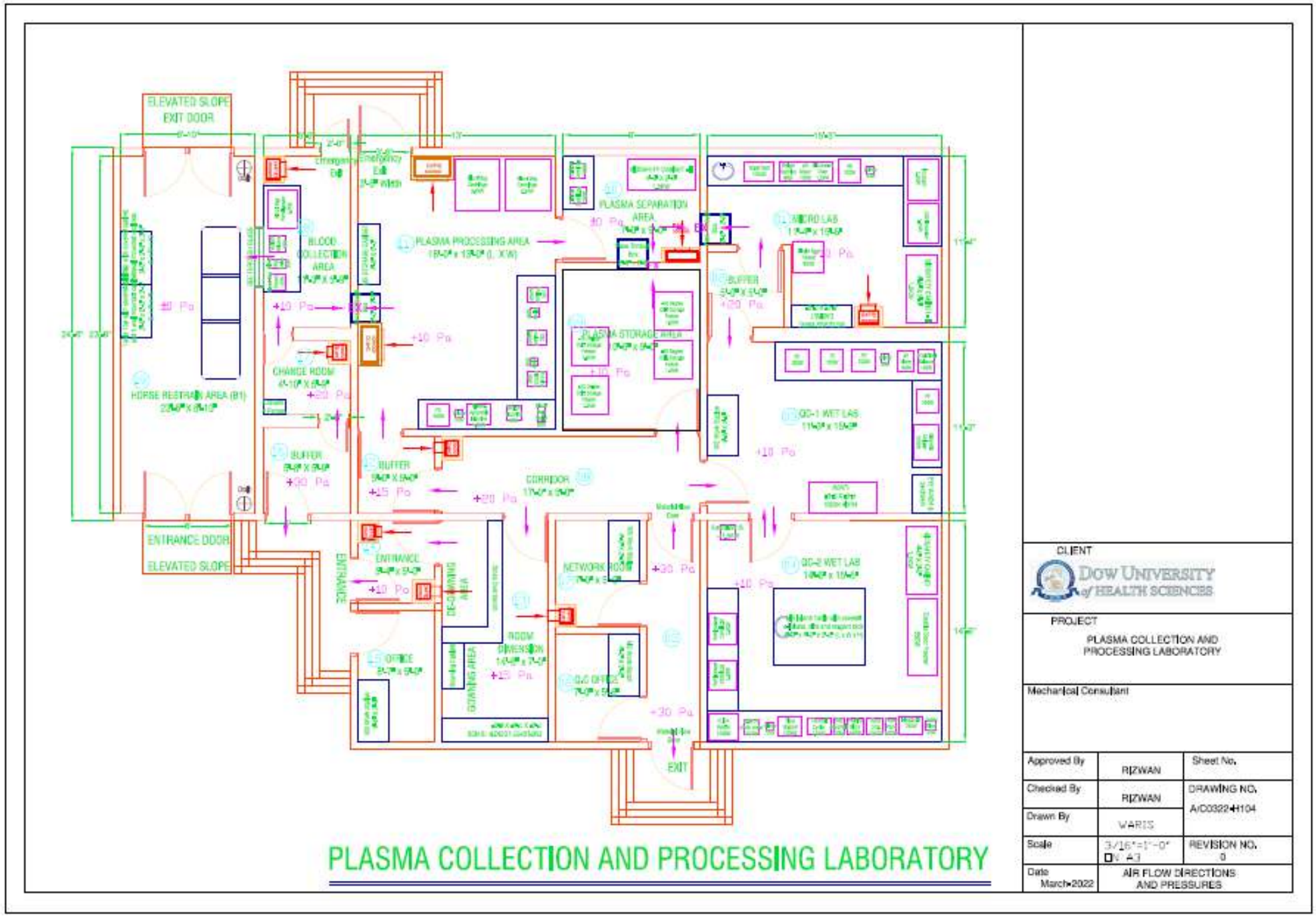
Approved By	RIZWAN	Sheet No.	
Checked By	RIZWAN	DRAWING NO.	A/C2022-H102
Drawn By	WARIS		
Scale	3/16"=1'-0" ON A3	REVISION NO.	0
Date March-2022	AREA LAYOUT		


CLASS-10,000
CLASS-100,000
COMFORT COOLING
EXHAUST/VENTILATION
ELEVATED SLOPE
EXIT DOOR
ENTRANCE DOOR
ELEVATED SLOPE
ENTRANCE
EXIT
CLIENT
DOW UNIVERSITY of HEALTH SCIENCES
PROJECT
PLASMA COLLECTION AND PROCESSING LABORATORY
Mechanical Consultant
Approved By
RIZWAN
Sheet No.
Checked By
RIZWAN
DRAWING NO.
A/C0000444108
Drawn By
WARIS
Scale
3/16"=1'-0"
REVISION NO.
0
Date
March-2022
AREA CLEAN ROOM CLASSIFICATION
PLASMA COLLECTION AND PROCESSING LABORATORY


ELEVATED SLOPE EXIT DOOR
PLASMA PROCESSING AREA
PLASMA SEPARATION AREA
BLOOD COLLECTION AREA
HORSE RESTRAIN AREA (B1)
CHANGE ROOM
BUFFER
PLASMA STORAGE AREA
MICRO LAB
GD-1 WET LAB
GD-2 WET LAB
CORRIDOR
ENTRANCE DOOR ELEVATED SLOPE
ENTRANCE
DE-GOWNING AREA
GOWNING AREA
NETWORK ROOM
OFFICE
GLO OFFICE
EXIT
PLASMA COLLECTION AND PROCESSING LABORATORY
CLIENT
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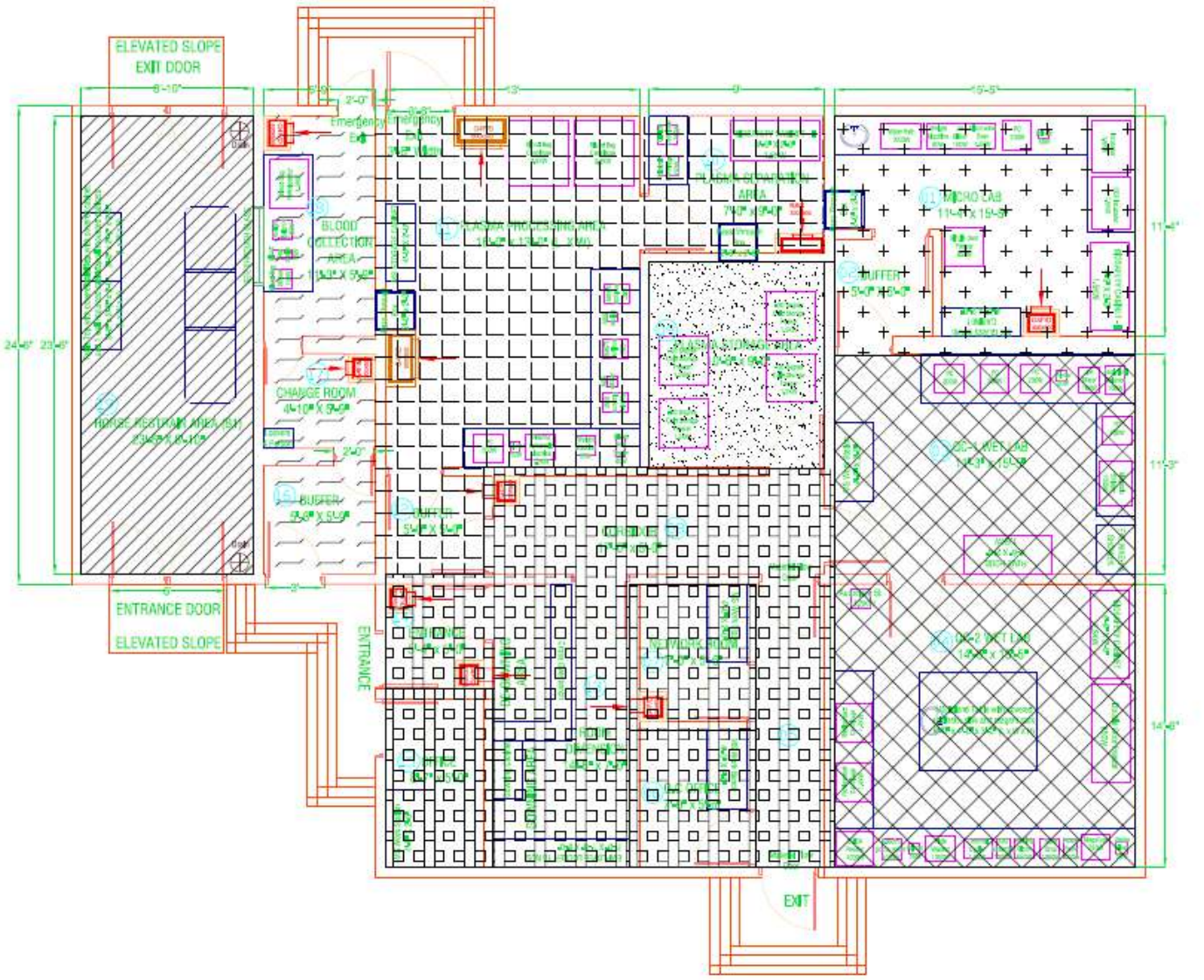
PLASMA COLLECTION AND PROCESSING LABORATORY
Mechanical Consultant
Approved By
RIZWAN
Sheet No.
Checked By
RIZWAN
DRAWING NO.
A/C0322+H104
Drawn By
WARIS
Scale
3/16"=1'-0"
ON A3
REVISION NO.
0
Date
March-2022
AIR FLOW DIRECTIONS AND PRESSURES



ZONE-01 (DX-VRF AHU) ML

ZONE-02 (DX-VRF AHU) QC

ZONE-03 (DX-VRF AHU)GOWN/DE-GOWN

ZONE-04 (DX-VRF AHU) PLASMA PROCESS

ZONE-05 (DX-VRF AHU)BLOOD COLLECTION

ZONE-06 (DX-VRF AHU)PLASMA STORE

ZONE-07 EXHAUST/VENT. FANS AND SPLIT A/C

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Approved By	RIZWAN	Sheet No.
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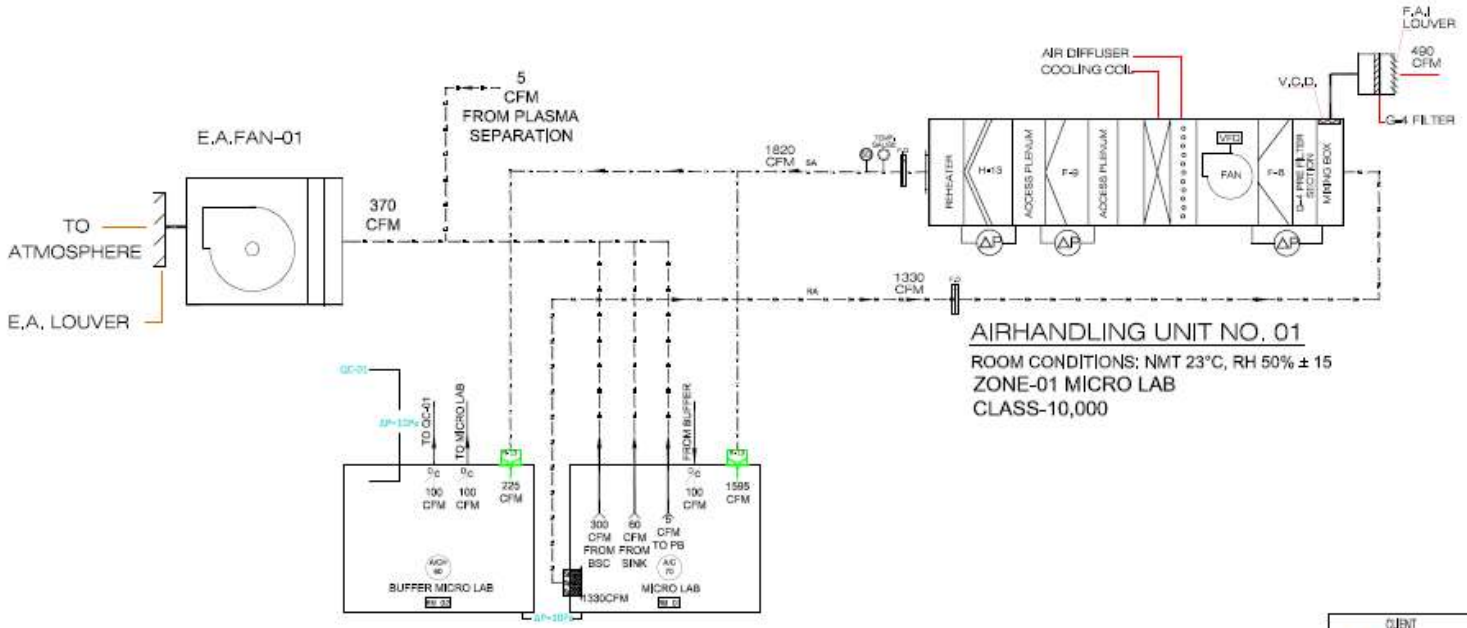
Drawn By	WARIS	
Scale	3/16"=1'-0" ON A3	REVISION NO. 0
Date March-2022	HVAC ZONNINGS	

PLASMA COLLECTION AND PROCESSING LABORATORY



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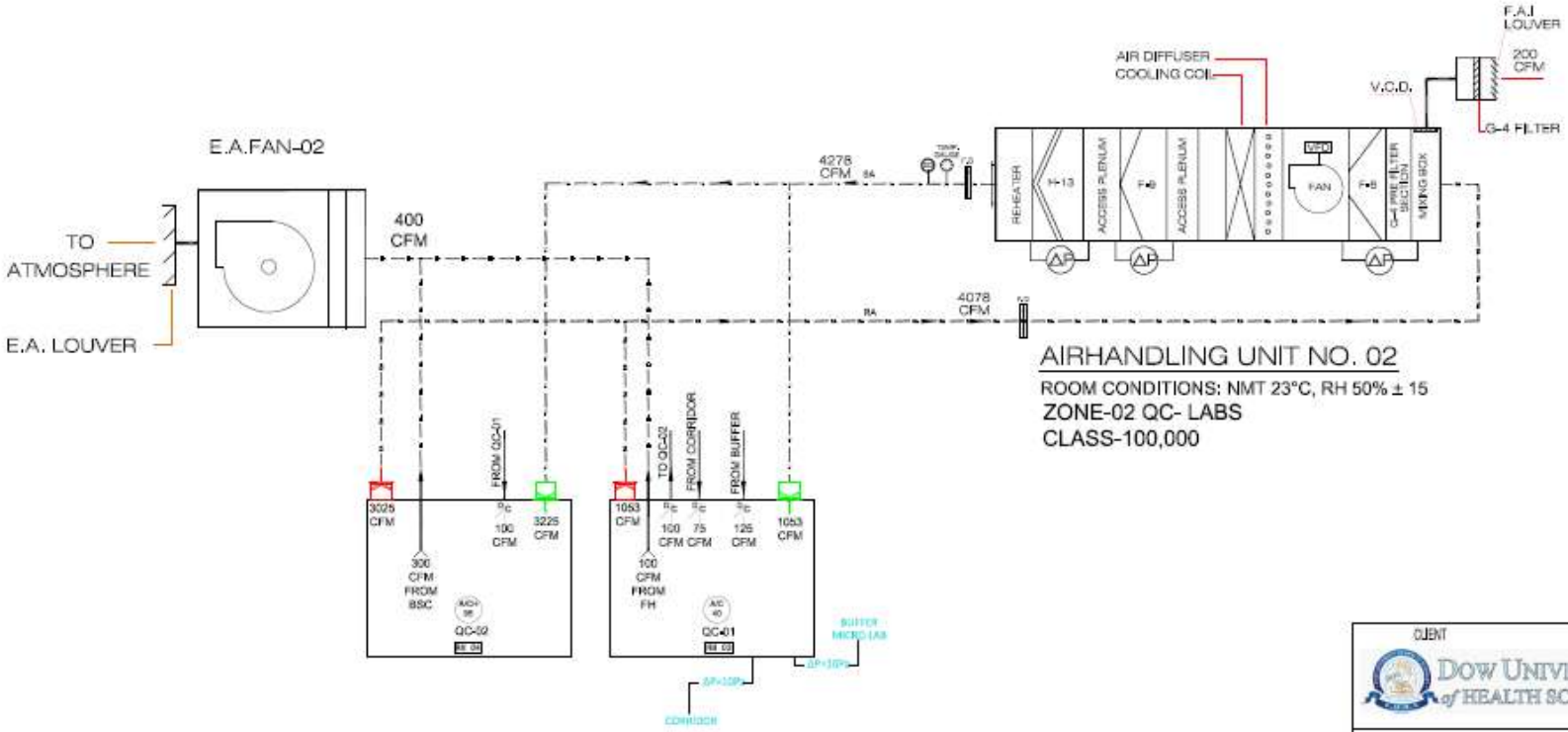
Approved By	RIZWAN	Sheet No.
Checked By	RIZWAN	DRAWING NO. A/C/2302-H106
Drawn By	WARIS	
Scale	3/16"=1'-0" ON A3	REVISION NO. 0
Date March-2022	AIR SCHEMATIC ZONE-01 (MICRO LAB)	



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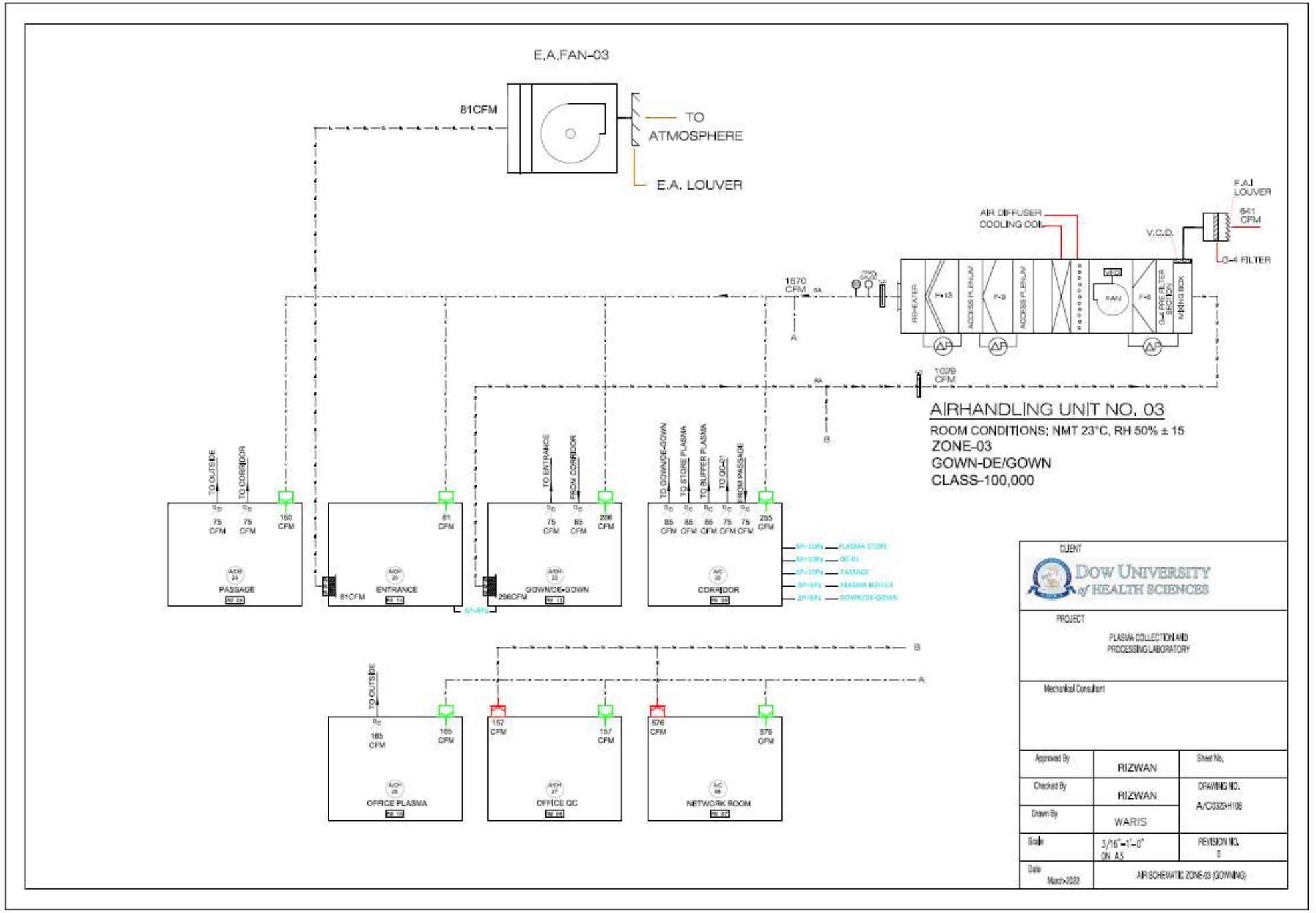
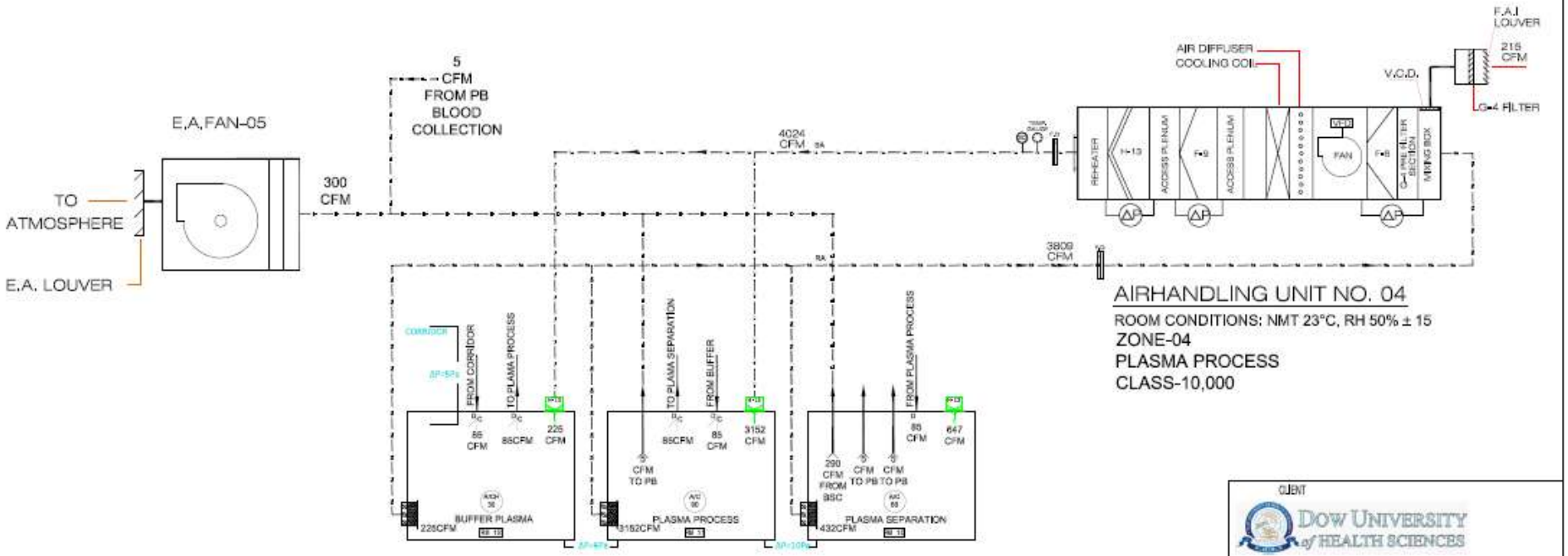
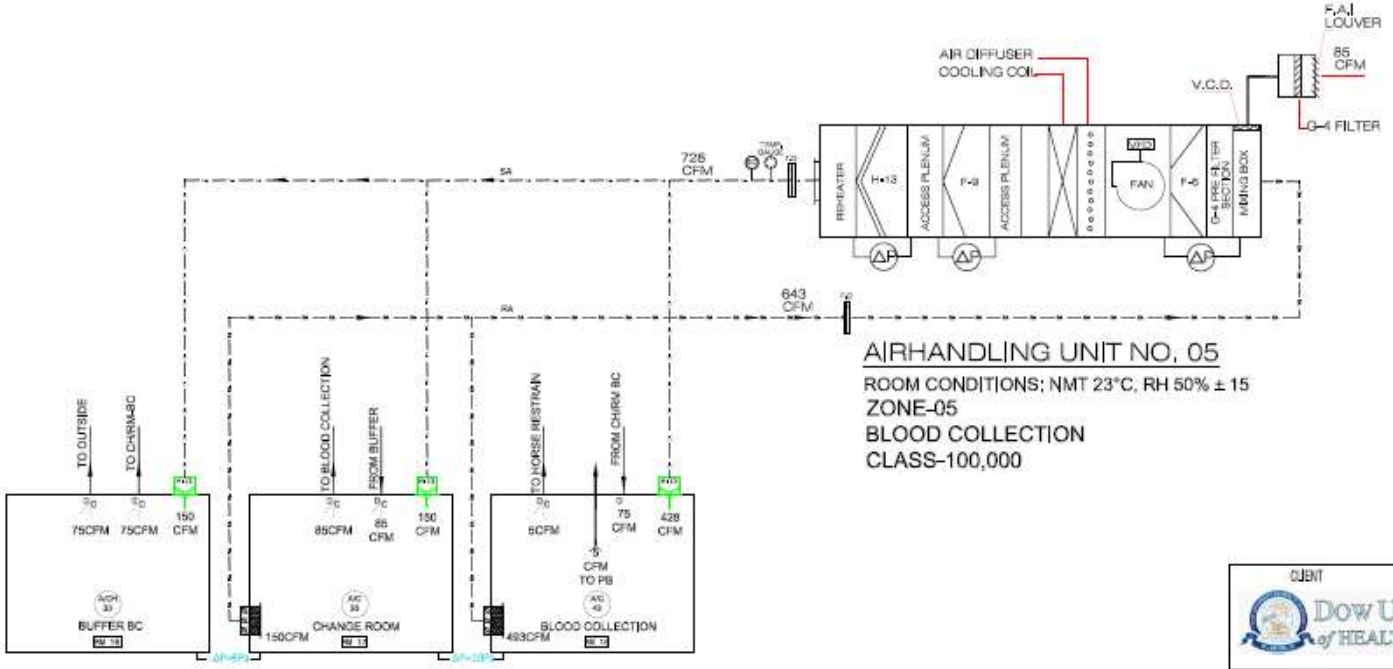
Approved By	RIZWAN	Sheet No,
Checked By	RIZWAN	DRAWING NO. A/C3302-H107
Drawn By	WARIS	
Scale	3/16"=1'-0" ON A3	REVISION NO. 0
Date March-2022	AIR SCHEMATIC ZONE-02 (QC- LABS)	


E.A.FAN-03
81CFM
TO ATMOSPHERE
E.A. LOUVER
F.A.I LOUVER
641 CFM
AIR DIFFUSER COOLING COIL
V.C.D.
0-4 FILTER
1670 CFM
1029 CFM
AIRHANDLING UNIT NO. 03
ROOM CONDITIONS; NMT 23°C, RH 50% ± 15
ZONE-03
GOWN-DE/GOWN
CLASS-100,000
PASSAGE
ENTRANCE
GOWN/DE-GOWN
CORRIDOR
OFFICE PLASMA
OFFICE QC
NETWORK ROOM
CLIENT
DOW UNIVERSITY of HEALTH SCIENCES
PROJECT
PLASMA COLLECTION AND PROCESSING LABORATORY
Mechanical Consultant
Approved By
RIZWAN
Checked By
RIZWAN
Drawn By
WARIS
Scale
3/16"=1'-0" ON A3
Date
March-2022
Sheet No.
DRAWING NO.
A/C/3320-H108
REVISION NO.
0
AIR SCHEMATIC ZONE-03 (GOWNING)


E.A.FAN-05
TO ATMOSPHERE
E.A. LOUVER
300 CFM
5 CFM FROM PB BLOOD COLLECTION
4024 CFM
3809 CFM
AIR DIFFUSER
COOLING COIL
V.C.D.
F.A.I LOUVER
215 CFM
G-4 FILTER
REHEATER
ACCESS PLENUM
FAN
MIXING BOX
AIRHANDLING UNIT NO. 04
ROOM CONDITIONS: NMT 23°C, RH 50% ± 15
ZONE-04
PLASMA PROCESS
CLASS-10,000
FROM CORRIDOR
TO PLASMA PROCESS
FROM BUFFER
TO PLASMA SEPARATION
FROM PLASMA PROCESS
BUFFER PLASMA
PLASMA PROCESS
PLASMA SEPARATION
225CFM
3152CFM
432CFM
CLIENT
DOW UNIVERSITY of HEALTH SCIENCES
PROJECT
PLASMA COLLECTION AND PROCESSING LABORATORY
Mechanical Consultant
Approved By
RIZWAN
Checked By
RIZWAN
Drawn By
WARIS
Scale
3/16"=1'-0" ON A3
Date
March-2022
Sheet No.
DRAWING NO.
A/C0320-H109
REVISION NO.
0
AIR SCHEMATIC ZONE-04 (PLASMA PROCESS)



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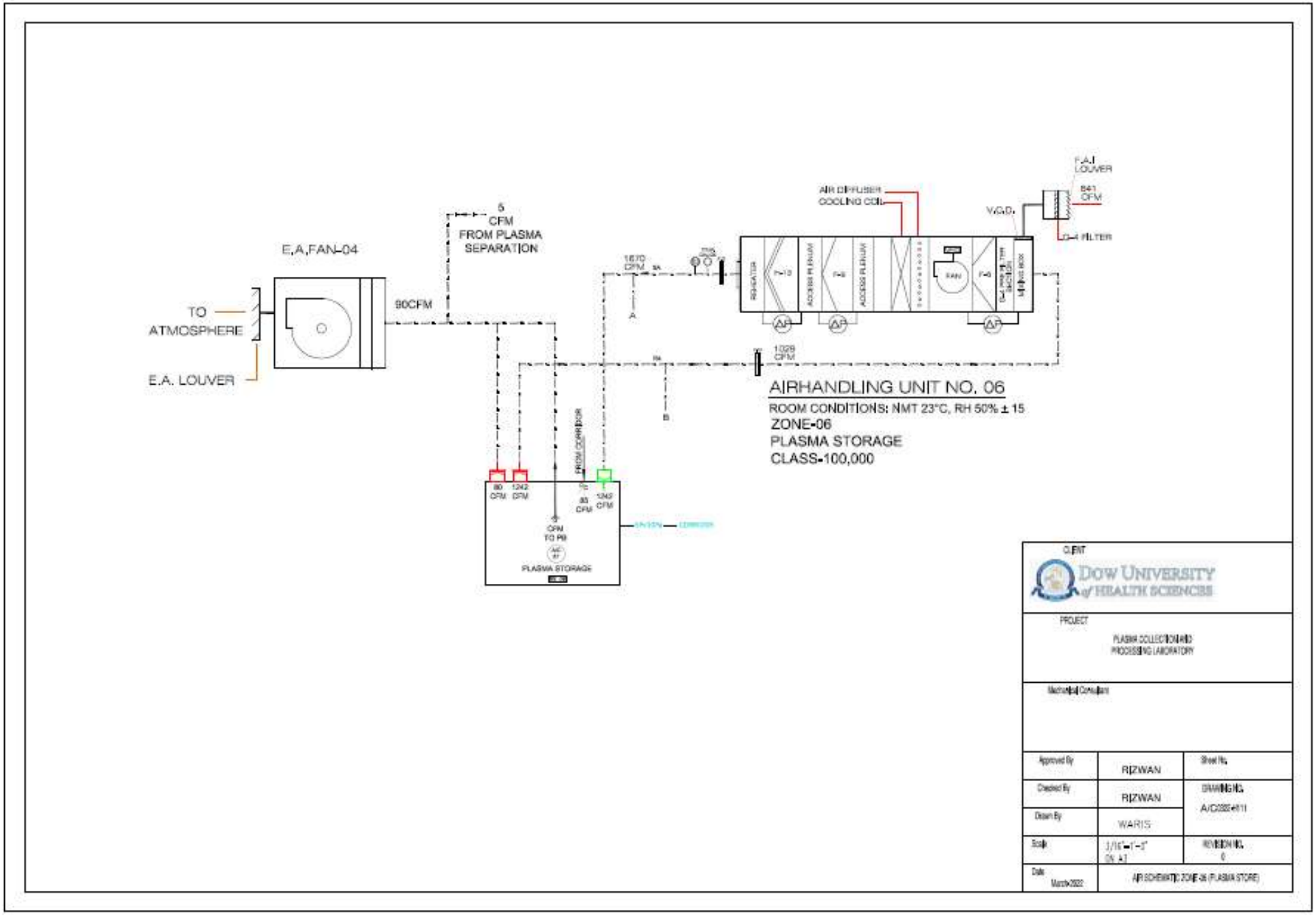
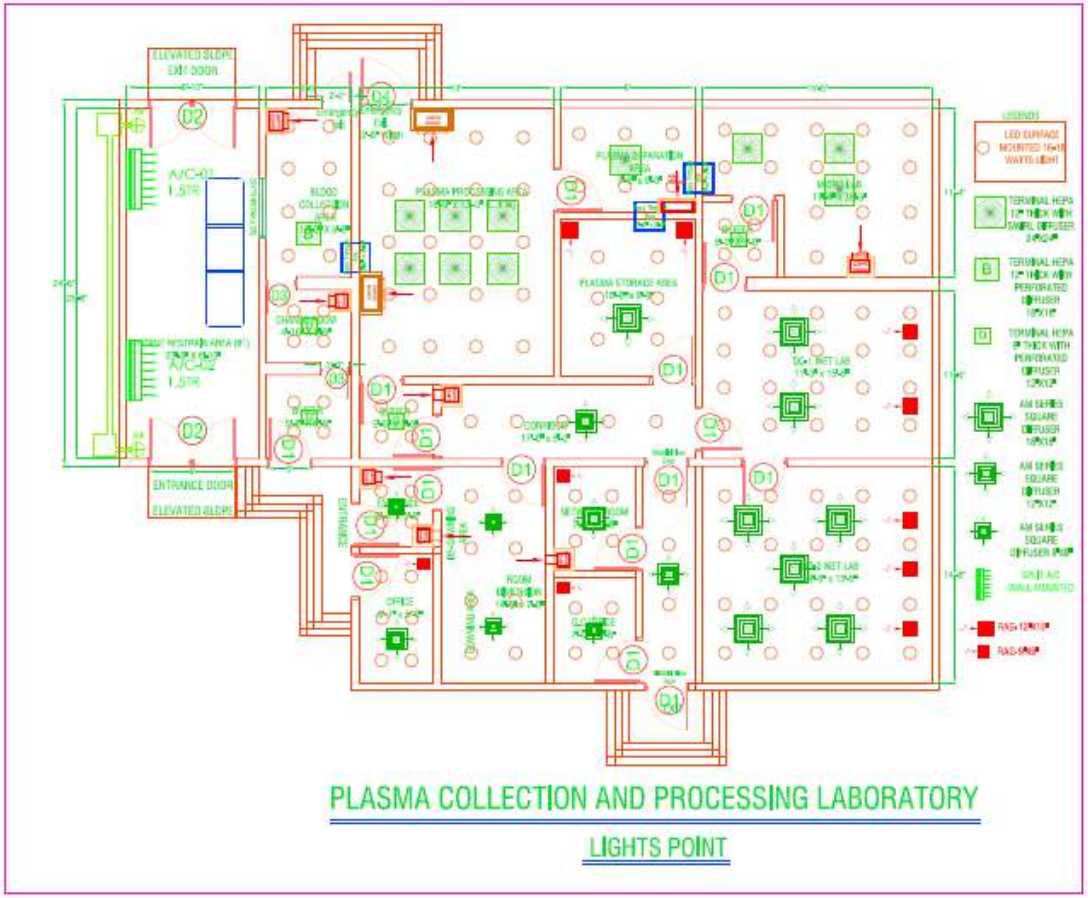
PLASMA COLLECTION AND PROCESSING LABORATORY

Mechanical Consultant

Approved By	RIZWAN	Sheet No.
Checked By	RIZWAN	DRAWING NO. A/C0332-H110
Drawn By	WARIS	
Scale	3/16"=1'-0" ON A3	REVISION NO. 0
Date March 2022	AIR SCHEMATIC ZONE-05 (BLOOD COLLECTION)	


E.A.FAN-04
TO ATMOSPHERE
E.A. LOUVER
90CFM
5 CFM FROM PLASMA SEPARATION
1670 CFM
1029 CFM
AIR DIFFUSER
COOLING COIL
V.V.D.
F.A.I LOUVER
841 CFM
FILTER
AIRHANDLING UNIT NO. 06
ROOM CONDITIONS: NMT 23°C, RH 50% ± 15
ZONE-06
PLASMA STORAGE
CLASS-100,000
80 CFM
1242 CFM
85 CFM
1242 CFM
CFM TO PB
PLASMA STORAGE
CLIENT
DOW UNIVERSITY of HEALTH SCIENCES
PROJECT
PLASMA COLLECTION AND PROCESSING LABORATORY
Approved By
RIZWAN
Checked By
RIZWAN
Drawn By
WARIS
Scale
Date
March-2022
AIR SCHEMATIC ZONE-06 (PLASMA STORE)



PLASMA COLLECTION AND PROCESSING LABORATORY

LIGHTS POINT

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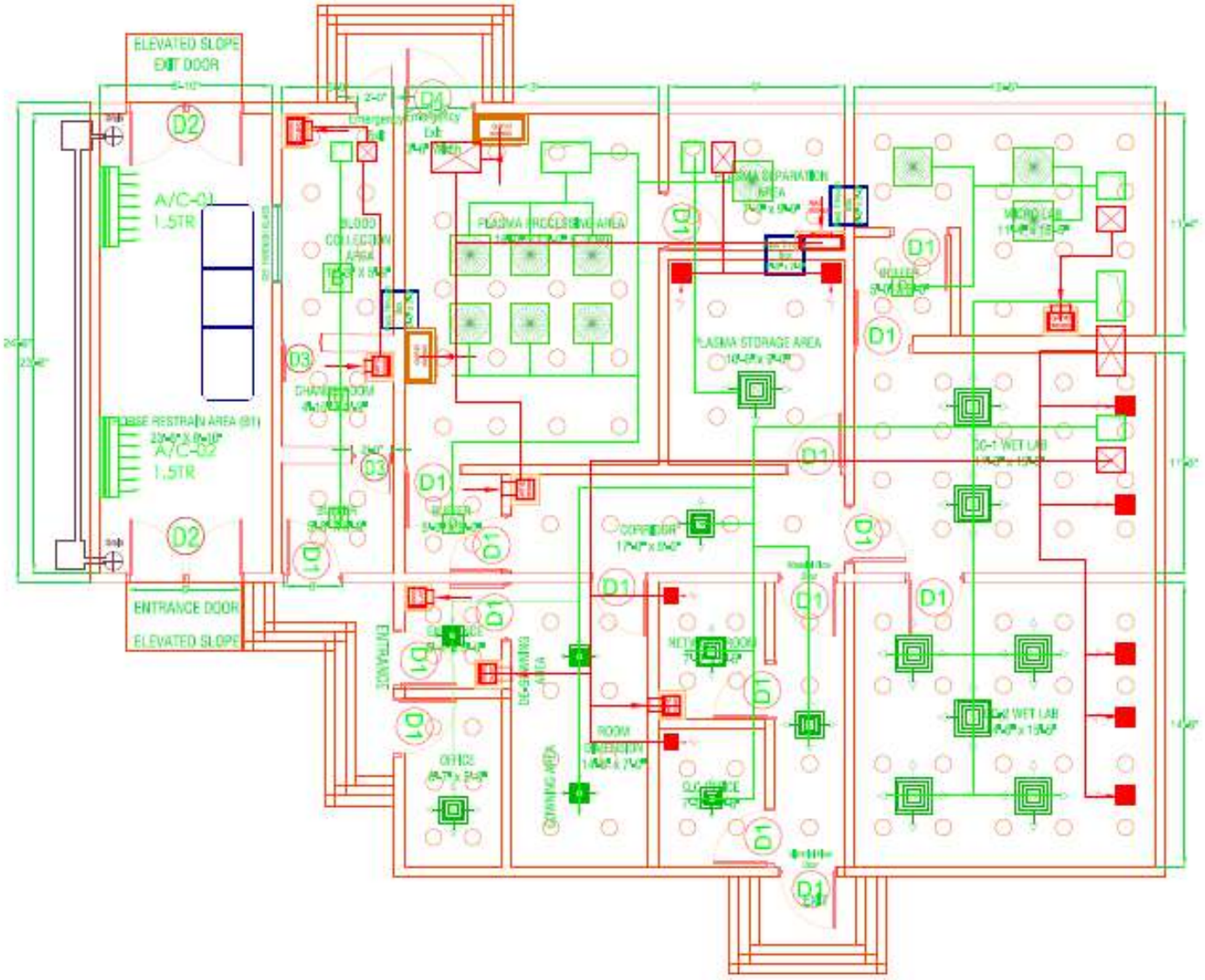
PLASMA COLLECTION AND PROCESSING LABORATORY

Mechanical Consultant

Approved By	RIZWAN	Sheet No.
Checked By	RIZWAN	DRAWING NO. A/C0322-H112
Drawn By	WARIS	
Scale	3/16"=1'-0" ON A3	REVISION NO. 0
Date March-2022	HVAC REFLECTED CEILING PLAN	



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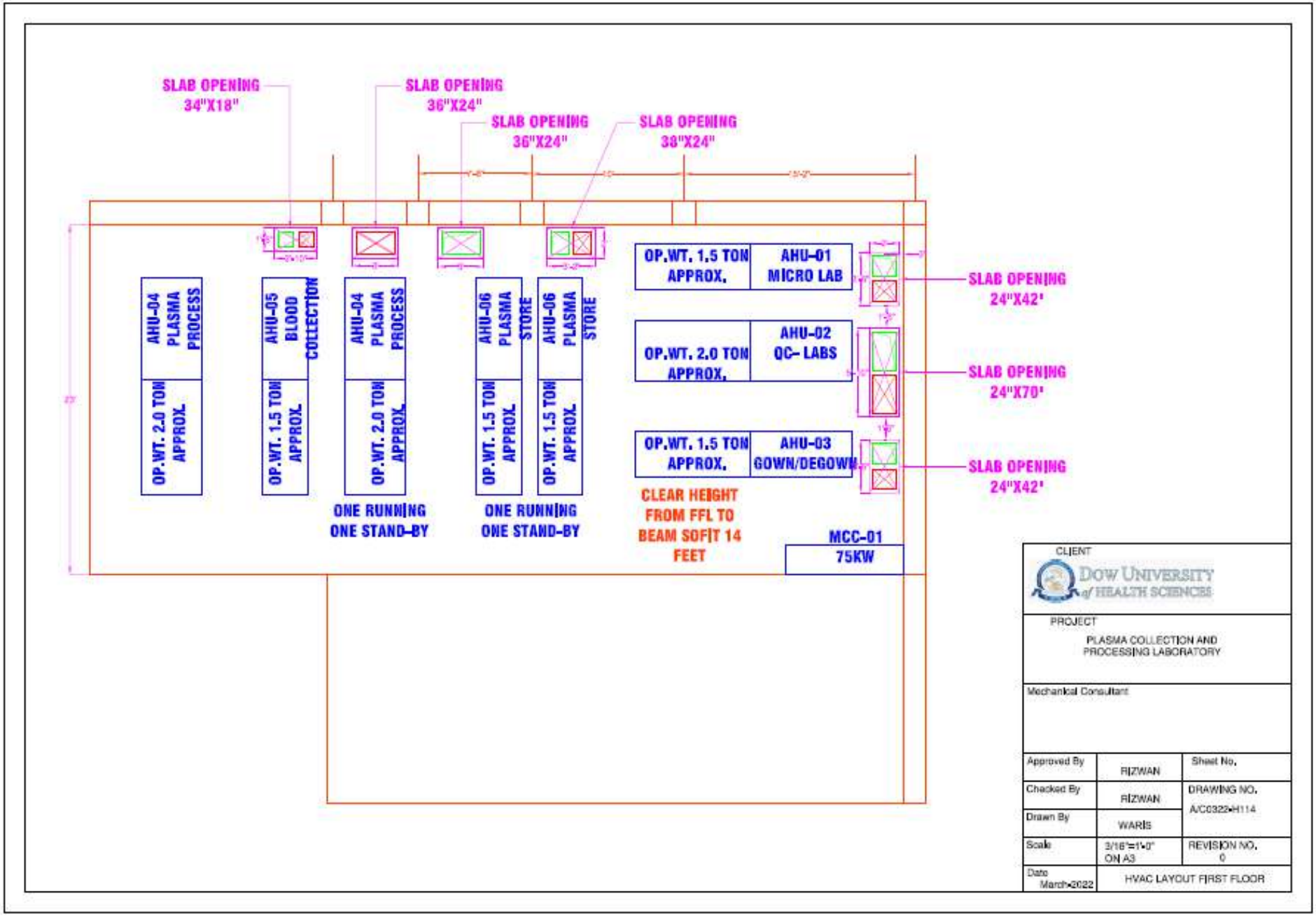
PLASMA COLLECTION AND PROCESSING LABORATORY

Mechanical Consultant

Approved By	RIZWAN	Sheet No.
Checked By	RIZWAN	DRAWING NO. A/C0322-H113
Drawn By	WARIS	
Scale	3/16"=1'-0" ON A3	REVISION NO. 0
Date March-2022	HVAC LAYOUT GROUND FLOOR	


SLAB OPENING
34"X18"
SLAB OPENING
36"X24"
SLAB OPENING
36"X24"
SLAB OPENING
38"X24"
AHU-04
PLASMA
PROCESS
OP.WT. 2.0 TON
APPROX.
AHU-05
BLOOD
COLLECTION
OP.WT. 1.5 TON
APPROX.
AHU-04
PLASMA
PROCESS
OP.WT. 2.0 TON
APPROX.
AHU-06
PLASMA
STORE
OP.WT. 1.5 TON
APPROX.
AHU-06
PLASMA
STORE
OP.WT. 1.5 TON
APPROX.
ONE RUNNING
ONE STAND-BY
ONE RUNNING
ONE STAND-BY
OP.WT. 1.5 TON
APPROX.
AHU-01
MICRO LAB
OP.WT. 2.0 TON
APPROX.
AHU-02
QC- LABS
OP.WT. 1.5 TON
APPROX.
AHU-03
GOWN/DEGOWN
CLEAR HEIGHT
FROM FFL TO
BEAM SOFIT 14
FEET
MCC-01
75KW
SLAB OPENING
24"X42'
SLAB OPENING
24"X70'
SLAB OPENING
24"X42'
CLIENT
DOW UNIVERSITY of HEALTH SCIENCES
PROJECT
PLASMA COLLECTION AND
PROCESSING LABORATORY
Mechanical Consultant
Approved By
RIZWAN
Sheet No.
Checked By
RIZWAN
DRAWING NO.
A/C0322-H114
Drawn By
WARIS
Scale
3/16"=1'-0"
ON A3
REVISION NO.
0
Date
March-2022
HVAC LAYOUT FIRST FLOOR

VRF-DX-AHUs DOUBLE DECK (TB1) WITH VRF CONDENSING UNITS

	AREA SERVED	FAN				FAN MOTOR			RETURN AIR FLOW	FRESH AIR FLOW	COOLING COIL									AIR FILTERS (600X600)				AIR FILTERS (600X300)			
		STATIC PRESSURE	SUPPLY AIR FLOW	EFF. %	TYPE	HP	ΔT	EFF. %			AIR ENTERING			AIR LEAVING			TOTAL CAPACITY	TOTAL CAPACITY	SENSIBLE CAPACITY	G4	F6	F9	H13	G4	F6	F9	H13
											DB	WB	ENTHALPY	DB	WB	ENTHALPY				EFFICIENCY %				EFFICIENCY %			
		IN.WG.	CFM				°F		CFM	CFM	°F	°F	BTU/LB	°F	°F	BTU/LB	BTU/HR	USRT	BTU/HR	90 ≥	65 ≥	95 ≥	99.95 ≥	90 ≥	65 ≥	95 ≥	99.95 ≥
1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	19	20	21	22	23	24	25	26	27	28	29	30
AHUs																											
AHU- 1	MICRO LAB	6.6	1820	70	CENT/PLUG	3.2	4.1	85	1,330	490	87.40	69.80	33.77	55.00	54.00	22.61	91404	8	63671	1	1	1	1	1	1	1	1
AHU- 2	QC-LABS	6.6	4278	70	CENT/PLUG	7.5	4.1	85	3,979	299	80.50	65.00	29.91	55.00	54.00	22.61	140579	12	117807	2	2	2	2	1	1	1	1
AHU- 3	GOWN/DE-GOWN ETC	6.6	1670	70	CENT/PLUG	2.9	4.1	85	1,029	641	91.50	72.50	36.11	55.00	54.00	22.61	101475	8	65831	1	1	1	1	1	1	1	1
AHU- 4	PLASMA PROCESS	6.6	4024	70	CENT/PLUG	7.0	4.1	85	3,809	215	79.50	64.20	29.33	55.00	54.00	22.61	121747	10	106481	2	2	2	2	1	1	1	1
AHU- 5	BLOOD COLLECTION	6.6	728	70	CENT/PLUG	1.3	4.1	85	643	85	81.40	65.60	30.40	55.00	54.00	22.61	25530	2	20757	1	1	1	1	x	x	x	x
AHU- 6	PLASMA STORE	6.6	1,242	70	CENT/PLUG	2.2	4.1	85	1,242	-	77.50	62.70	28.22	55.00	54.00	22.61	31375	3	30185	1	1	1	1	x	x	x	x

NOTES:

1. The unit shall have CFC free R 40 7c / 410 refrigerant.
2. All in door units shall be double skinned type with no thermal bridge between inner and outer surface, The coils shall have corrosion proof (acracled) coatingon the fins.
3. The Indoor Fan external static pressure as specified above includes pressure loss in supply and return duct systems and all types of air filters. The manufacturer to add pressure losses in cooling coil (wet), unit cabinet, and fan inlet outlet losses to determine fan total static pressure requirement.
4. Maximum face velocity/fin for cooling coils 500 fpm/10fins per inch and There shall be no carry over of water droplets from the cooling coil.
5. All dampers to be opposed blade type suitable for motorized operation, The blade to have nylon bearings/ball bearings for smooth movement, Dampers to be sectionalized to limit blade length and prevent warpage assuring tight closure.
6. The dampers to be installed in plenums as shown on drawings.
7. For indoor unit access doors shall be provided with double glass view ports, Access plenums with hinged doors shall be provided before each bag filter section, Vapor proof lamps in each sections, Weather proof junction box for electric connection with disconnect switch and light switch to be provided on each unit.
8. The indoor unit shall be factory tested for air leakage, Cooling and coil leakage test reports shall be delivered to the Client before shipment of the Units.
9. The cooling coil shall be operated by DX System; system having capacity more than 7.5 HP shall have two independent circuits and shall have temperature control, The Units shall be provided with initial charge of refrigerant , copper piping with insulation upto 60 ft length.
10. Condensing units to operate without overloading with ambient upto 120/84 °F DB/WB and to operate satisfactorily with ambient temperature variation summer 114/84 °F DB/WB winter 40/38 °F DB/WB.
11. Condenser and evaporator coil to have acracled anti-corrosion coating and the condensing unit shall have special marine type external paint for corrosion protection with SS nuts & bolts.
12. All joints shall be filled with Silicon, In door (evaporator units coming in knock down condition shall be assembled at site and the joints filled with Silicon.

AHU CONSTRUCTION FEATURES & CHARACTERISTICS

SR. NO.	ITEM	SPECIFIED	IMPORTANT REMARKS
1	Casing		
	Insulation Thickness	60 mm	
	Insulation Type	Polyurethane (PU)	
	Internal Sheet Thickness	0.6 mm	
	External Sheet Thickness	1.2 mm	
	Internal Sheet	SS316L	
	External Sheet Coating	GI Pre-coated	
2	Filter		
	Frame Material	Powder Coated GI (S)	
	Bag filter length (F-6, F-9)	(Long Type)	
	Hepa Filter length (H-13)	292 mm	
	Face Velocity	Less than 400 fpm	(AAF, CAMFIL, TROX)
3	Cooling Coil		
	Coils	Copper	
	Fin	Aluminium (S)	
	Coil Frame	M (S)	
	Coil Header	Copper	
	Face Velocity		
4	Drain Pan		
	Material	SS316L	
5	Nuts & Bolts	Stainless Steel	
6	Weather Proof Canopy	OUTDOOR ONLY	
7	Blower		
	Type of Fan	Plug	Cosmo, Kruger, Nicotra
8	Motor		
	IP Rating	IP55 (S)	
	Class	F (S)	
	International Efficiency	IE2	Siemens, Nrool, ABB
9	Accessories		
	Marine Lamp & Window	Yes	LED Type
	Magnahelic Gauge	Only Port Required.	
	VFD Supply (Class)	Yes (IP-20)	Schenieder/Danfoss/ABB (Modbus/Provision of Secret)
	VFD Pre-installed at AHU	Yes. With Shielded Wire	
	AHU Internal Wiring	Yes	
10	Certification		
	COIL CERTIFICATION	ARI	
	SELECTION SOFTWARE CERTIFICATION	EUROVENT	
	AHU CERTIFICATION	EUROVENT	Hygienic Certification – VDI 6022 will be
11	MECHANICAL CHARACTERISTICS	Casing Strength	D1
		Casing Air Leakage	L1
		Filter Bypass Leakage	F9
		Thermal Transmittance	T2
		Thermal Bridging	TB2
12	PERFORMANCE TEST AT FACTORY	Optional	As per Eurovent Certified procedure

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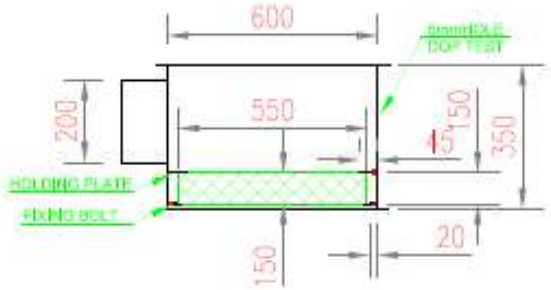
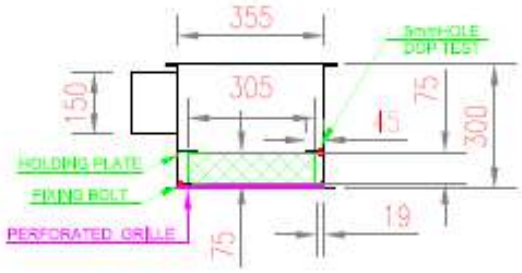
PLASMA COLLECTION AND PROCESSING LABORATORY

Mechanical Consultant

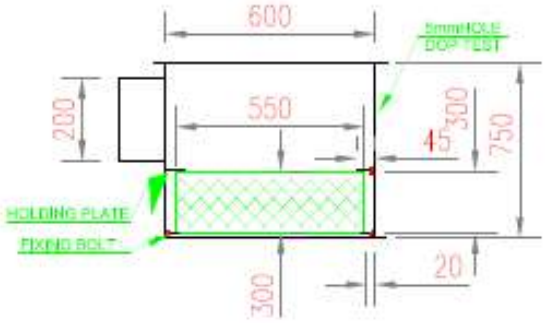
Approved By	RIZWAN	Sheet No.
Checked By	RIZWAN	DRAWING NO. A/C0322-H116
Drawn By	WARIS	
Scale	N.T.S.	REVISION NO. 0
Date March-2022	AHUs SCHEDULE OPERATING CONDITIONS	



HOUSING FOR 600x600x150 HEPA MEDIA H-13



HOUSING FOR 305x305x69 HEPA MEDIA



HOUSING FOR 600x600x300 HEPA MEDIA H-13

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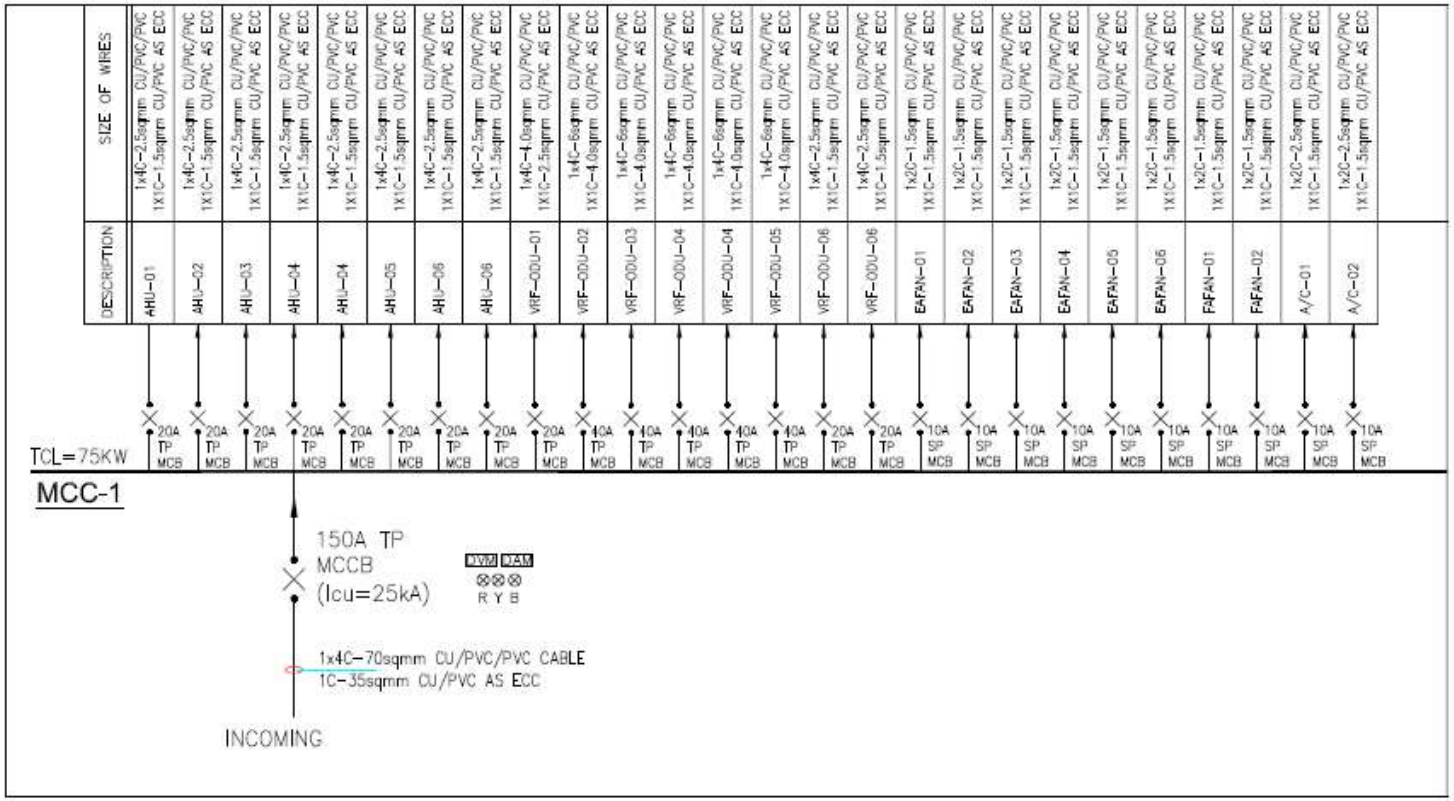
Drawn By	WARIS	
Scale	N.T.S	REVISION NO. 0
Date March-2022	HEPA HOUSING DETAIL	



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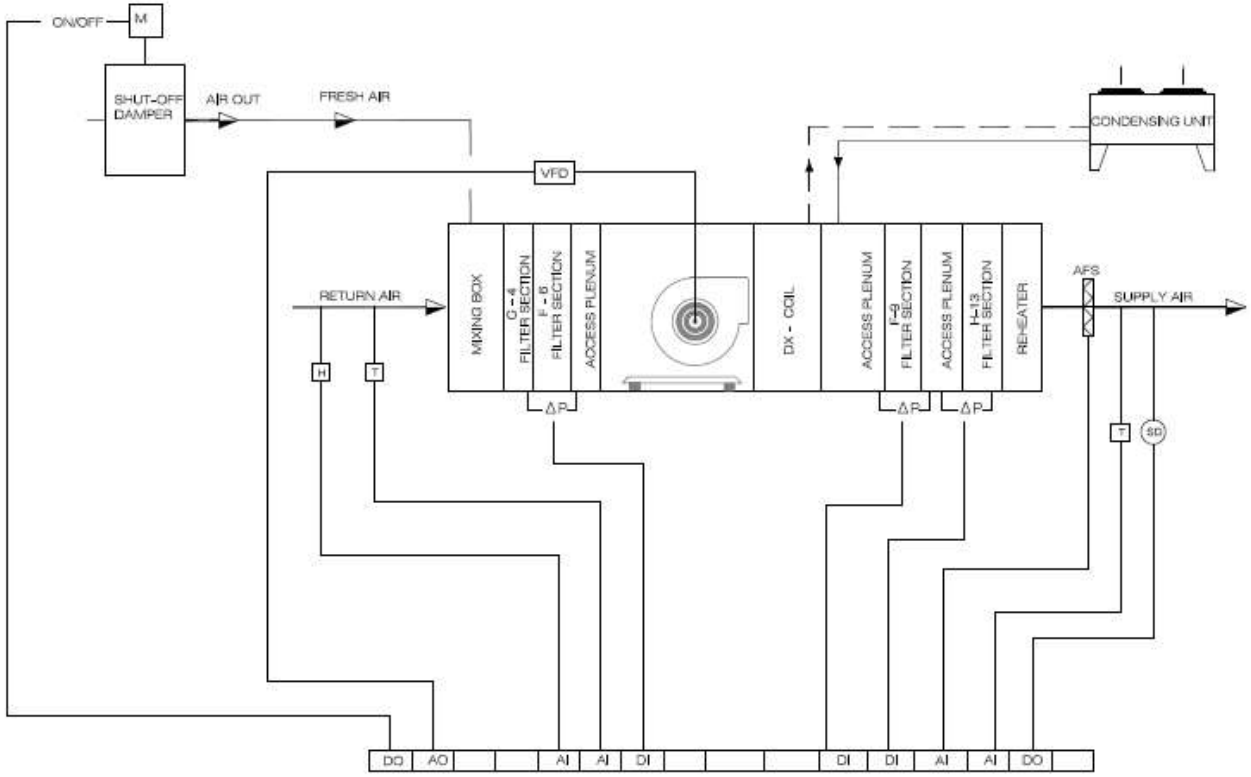
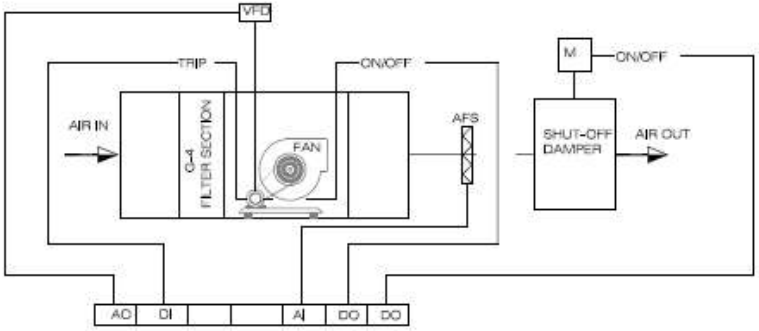
Drawn By	WARIS	
Scale	N.T.S	REVISION NO. 0
Date March-2022	HVAC ELECTRICAL SINGLE LINE DIAGRAM	



AHU-01/02/03/04/05/06



EXHAUST FAN NO-01/02/03/04/05/06

LEGEND	
SYMBOL	DESCRIPTION
ΔP	PRESSURE DIFFERENTIAL
AI	ANALOG IN
AO	ANALOG OUT
DI	DIGITAL IN
DO	DIGITAL OUT
T	TEMPERATURE SENSOR
H	HUMIDITY SENSOR
F	FLOW SWITCH
P	PRESSURE SWITCH
C/S	CURRINT SWITCH
AFS	AIR FLOW STATION.
SD	SMOKE DETECTOR.
VFD	VARIABLE FREQUENCY DRIVE.

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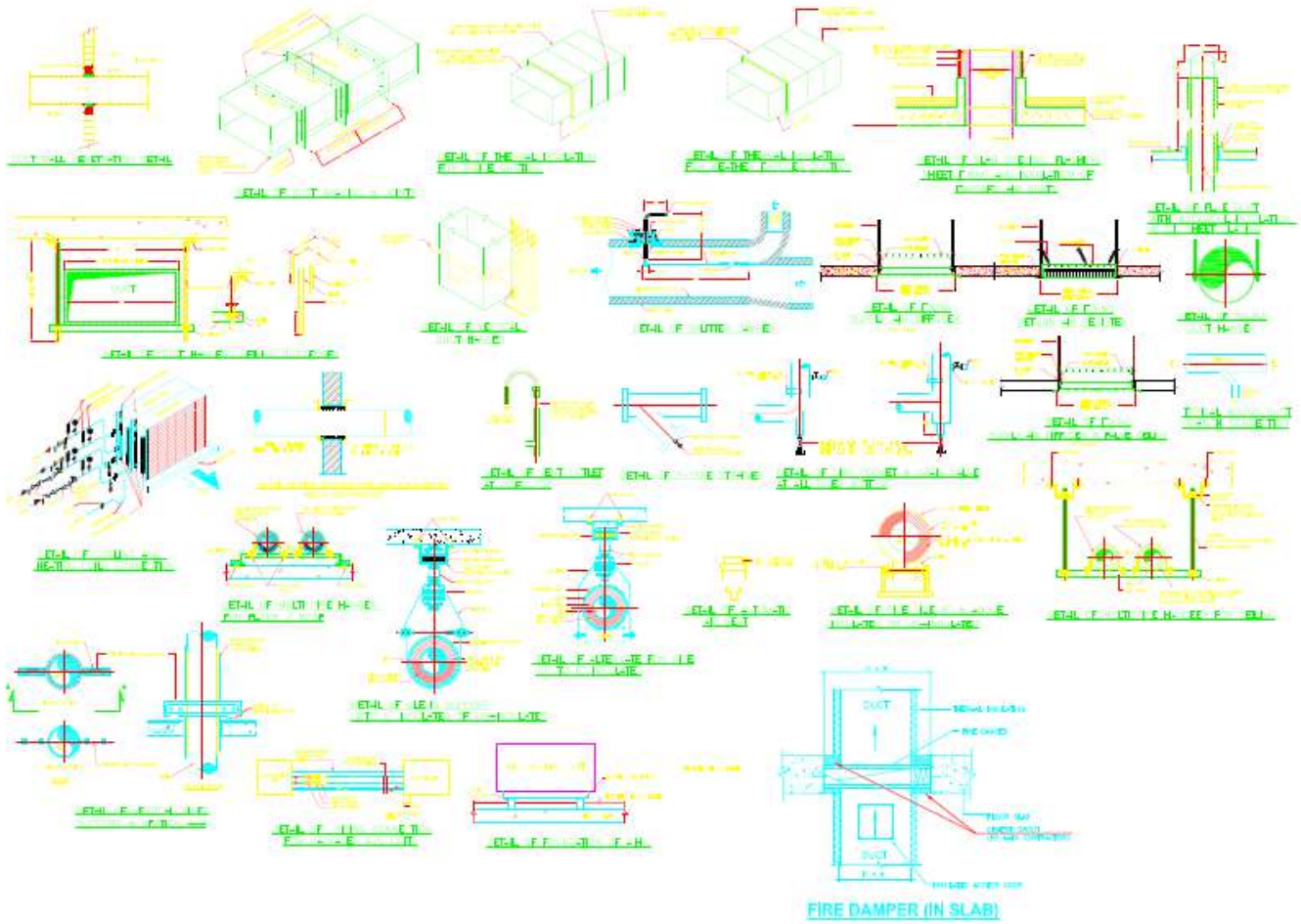
Drawn By	WARIS	
Scale	N.T.S	REVISION NO. 0
Date March-2022	DIRECT DIGITAL CONTTROLS	



FIRE DAMPER (IN SLAB)

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Drawn By	WARIS	
Scale	N.T.S	REVISION NO. 0
Date March-2022	HVAC MISC DETAIL	