PESHAWAR INSTITUTE OF CARDIOLOGY MEDICAL TEACHING INSTITUTION

STANDARD BIDDING DOCUMENTS
"Turnkey Project"

Procurement of
Supply, Installation, Testing & Commissioning of HVAC system (Condenser Units & AHU's) for Operation Theater and CSSD at Peshawar Institute of Cardiology PIC-MTI.

Tender :REF: (PIC-056)

S#	Description	Bid Security	Tender Process
1	**Supply, Installation, Testing & Commissioning of HVAC system (Condenser Units & AHU's) for Operation Theater and CSSD at Peshawar Institute of Cardiology PIC-MTI.**	**4% of the Total bid value**	**Single Stage Two Envelope**

(PROCUREMENT SPECIFIC PROVISIONS)

- Invitation for Bids (IFB)
- Bid Data Sheet (BDS)
- Special Conditions of Contract (SCC)
- Schedule of Requirements
- Technical Specifications
- Sample Forms
- Eligibility

Preface

These Bidding Documents have been prepared for use by procuring agencies in the procurement of goods through National Competitive Bidding (NCB).

In order to simplify the preparation of bidding documents for each procurement, the Bidding Documents are grouped in two parts based on provisions which are fixed and that which are specific for each procurement. Provisions which are intended to be used unchanged are in Part one, which includes Section I, Instructions to Bidders, and Section II, General Conditions of Contract. Data and provisions specific to each procurement and contract are included in Part Two which includes Section II, Bid Data Sheet; Section III, Special Conditions of Contract; Section IV, Schedule of Requirements; Section V, Technical Specifications; and the forms to be used in Section I, Invitation for Bids, and Section VI, Sample Forms.

This is Part Two and contains data and provisions specific to each procurement. Care should be taken to check the relevance of the provisions of the Bidding Documents against the requirements of the specific goods to be procured. The following general directions should be observed when using the documents. In addition, each section is prepared with notes intended only as information for the Procuring agency or the person drafting the bidding documents. They shall not be included in the final documents, except for the notes introducing Section VI, Forms, where the information is useful for the Bidder.

a. Specific details, such as the "name of the Procuring agency" and "address for bid submission," should be furnished in the Invitation for Bids, in the Bid Data Sheet, andin the Special Conditions of Contract. The final documents should contain neither blank spaces nor options.
b. Amendments, if any, to the Instructions to Bidders and to the General Conditions of Contract should be made through the Bid Data Sheet and the Special Conditions of Contract, respectively.
c. Footnotes or notes in italics included in the Invitation for Bids, Bid Data Sheet, Special Conditions of Contract, and in the Schedule of Requirements are not part of the text of the document, although they contain instructions that the Procuring agency should strictly follow. The final document should contain no footnotes.
d. The criteria for bid evaluation and the various methods of evaluation in the Instructions to Bidders (Clauses 25.3 and 25.4, respectively) should be carefully reviewed. Only those that are selected to be used for the procurement in question should be retained and expanded, as required, in the Bid Data Sheet or in theTechnical Specifications, as appropriate. The criteria that are not applicable shouldbe deleted from the Bid Data Sheet.

e. Clauses included in the Special Conditions of Contract are illustrative of the provisions that should be drafted specifically by the Procuring agency for each procurement.

f. The forms provided in Section VI should be completed by the Bidder or the Supplier; the footnotes in these forms should remain, since they contain instructions whichthe Bidder or the Supplier should follow.

Table of Contents - Part Two	
Section I. Invitation for Bids	
Section II. Bid Data Sheet	
Section III. Special Conditions of Contract	
Table of clauses	
Section IV. Schedule of Requirements	
Section V. Technical Specifications	
Section VI. Sample Forms	
Sample Forms	
1. Bid form and Price Schedules	
2. Bid Security Form	
3. Contract Form	
4. Performance Security Form	
5. Manufacturer's Authorization Form	
6. Integrity Pact	

Part Two

Section I. Invitation for Bids

Notes on the Invitation for Bids

The Invitation for Bids (IFB) has been issued as an advertisement in leading newspapers of general circulation in the Province of Khyber Pakhtunkhwa as well as on the web site of the Peshawar Institute of Cardiology (www.pic.edu.pk) by allowing at least fifteen days for NCB for bid preparation and submission.

The Invitation for Bids provides information that enables interested bidders to decide whetherto participate. Apart from the essential items listed in the Standard Bidding Documents (SBD), the Invitation for Bids also indicates the important bid evaluation criteria or qualification requirement (for example, a requirement for a minimum level of experience in manufacturing a similar type of goods for which the Invitation for Bids is issued) so that the bidders should give their best and final prices as no negotiations are allowed.

The Invitation for Bids is incorporated into these Standard Bidding Documents (SBDs). The information contained in the Invitation for Bids (IFB) conforms to the bidding documents and in particular to the relevant information in the Bid Data Sheet.

INVITATION FOR BIDS

REF No. PIC-056

1. Peshawar Institute of Cardiology, Medical Teaching Institute (PIC-MTI) is the project of the KhyberPakhtunkhwa (KP) Health Department to improve cardiac facilities in the public sector in theareas of research and treatment.

2. Peshawar Institute of Cardiology (PIC-MTI) invites sealed Bids from (Firms/company/Authorized Dealers mentioned in BSD) registered with Income Tax and Sales Tax and reflected on Active Tax Payer (ATL) list of FBR. Detailed of items, specification, submission, Opening and method of evaluation is provided in bidding documents. Bid Security/earnest money is required to be submitted in shape of Call Deposit Receipt (CDR)/Bank Guarantee from schedule bank of Pakistan in favor of **Hospital Director. Peshawar Institute of Cardiology.**

S#	Description	Bid Security	Tender Process
1	**Supply, Installation, Testing & Commissioning of HVAC system (Condenser Units & AHU's) for Operation Theater and CSSD at Peshawar Institute of Cardiology PIC-MTI.**	**4% of the Total bid value**	**Single Stage Two Envelope**

3. Only typed bids on original letter pad, sealed & signed shall be submitted, hand written tender shall not be acceptable. The tenders must be according to hospital specification; alternate rates will not be acceptable.

4. Income Tax, stamp duty, General Sales Tax (GST) and Professional Tax or any other Government tax will be charged as per rules.

5. A complete set of Standard Bidding Document may be downloaded by interested Bidder from websites of Peshawar Institute of Cardiology (PIC-MTI) (http://pic.edu.pk) after publication of thisadvertisement in the newspaper till last day for submission of Bid.

6. Procurements will be carried out as per rules 6 (b) of Khyber Pakhtunkhwa Public Procurement Regulatory Authority (KPPRA) Rules 2014 single Stage Two Envelope.

7. A bid accompanied by Pay Order (PO) shall be rejected.

8. A Pre-Bid Meeting will be held on **September 29th , 2022 at 10:00 AM (PST)** at the office of the Manager MaterialManagement, 1st floor OPD block, Peshawar Institute of Cardiology (PIC-MTI) Prospective Bidder are encouraged to attend the meeting.

9. Bids are to be delivered to the office of the Manager Material Management, 1st floor OPD block, Peshawar Institute of Cardiology (PIC-MTI) on or before **October 13, 2022 at 11:00 AM (PST).**

10. Bids shall be opened on the **same day at 11:30 PM (PST)** in the presence of bidders who choose to attend.

11. The advertisement is also available both on the websites of Peshawar Institute of Cardiology (PIC-MTI) (http://pic.edu.pk) and KPPRA (http://kppra.gov.pk).

12. Peshawar Institute of Cardiology (PIC-MTI) reserves the right to cancel any or all bids by assigning cogent reason under Rule 47 Khyber Pakhtunkhwa public procurement RegulatoryAuthority.

Hospital Director
Peshawar Institute of Cardiology (PIC-MTI)
5-A, Sector B-3, Phase-V, Hayatabad,
Peshawar,Ph: +92 91 9219645.

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Section II. Bid Data Sheet

DATA SHEET		
Reference ITB	Introduction/Description	**Detail**
ITB 1.1	Name of Procuring Agency of Government of Khyber Pakhtunkhwa.	**Peshawar Institute of Cardiology, Medical Teaching Institution Peshawar.**
ITB 1.1	Loan or credit or Project allocation number. Loan or credit or Project allocation amount.	**Budget allocated by Government Khyber Pakhtunkhwa to Peshawar Institute of Cardiology.**
ITB 1.1	Name of Project.	**Procurement of Supply, Installation, Testing & Commissioning of HVAC system (Condenser Units & AHU's) for Operation Theater and CSSD at Peshawar Institute of Cardiology PIC-MTI. (PIC-056)**
ITB 1.1	Name of Contract.	**Procurement of Supply, Installation, Testing & Commissioning of HVAC system (Condenser Units & AHU's) for Operation Theater and CSSD at Peshawar Institute of Cardiology PIC-MTI. (PIC-056)**
ITB 4.1	Name of Procuring agency.	**Peshawar Institute of Cardiology, Medical Teaching Institution Peshawar.**
ITB 6.1	Procuring agency's address, telephone, telex, and facsimile numbers.	**Peshawar Institute of Cardiology - MTI Plot No.5-A, Sector B-3, Phase-V, Hayatabad, Peshawar – Pakistan 091-9219645**
ITB 8.1	Language of the bid.	**English**
BID PRICE AND CURRENCY		
ITB 11.2	The price quoted shall be	**The bidder must quote DDP Prices. The price should be in PKR.** **No LC will be open by PIC-MTI. It will be the sole responsibilities of the winning bidder to deliver equipment at PIC-MTI without any cost to PIC-MTI.**
ITB 11.4	The Price shall be fixed	**The quoted prices will be valid till 30th June 2023.**
PREPARATION AND SUBMISSION OF BIDS		
ITB 13.3 (d)	Qualification requirements.	**(Manufacturer /Authorized Dealers)**

ITB 14.3 (b)	Spare parts required for years of operation.	**One year free of cost provision of services and spare parts under warranty period after the successful installation of the equipment.**
ITB 15.1	Amount of bid security.	**4% of the total Bid Value** **Bid security shall be submitted to the amount of four percent (4%) of the quoted bid value in shape Call Deposit Receipt (CDR) from the account of bidder from scheduled bank of Pakistan in the name of Hospital Director Peshawar Institute of Cardiology.** **(a) The Bid security shall be forfeited:** • **If a bidder withdraws his bid during the period of bid validity; or** • **If a bidder doesn't accept the correction of his Bid Price, pursuant to Para above; or** **(b) In the case of a successful bidder, if he fails to:** • **Furnish the Performance security in accordance with Para 7.1 of SC;** • **Sign the contract agreement** **The copy of the bid security should be placed in Technical Bid not showing the amount.** **An affidavit is also mandatory showing that the bid security is attached in the financial Bid.**
ITB 16.1	Bid validity period.	**180 days from the date of opening of bids**
ITB 17.1	Number of copies.	**One (original bid) in hard tap binding.**
ITB 18.2 (a)	Address for bid submission.	**Hospital Director** **Peshawar Institute of Cardiology - MTI** **Plot No.5-A, Sector B-3, Phase-V,** **Hayatabad,** **Peshawar – Pakistan**
ITB 18.2 (b)	IFB title and number.	**Procurement of Supply, Installation, Testing & Commissioning of HVAC system (Condenser Units & AHU's) for Operation Theater and CSSD at Peshawar Institute of Cardiology PIC-MTI. (PIC-056)**
ITB 19.1	Deadline for bid submission.	**11:00 AM Sharp. 13-10-22**
ITB 19.3	Pre-Bid meeting with the bidders	**29-09-22 At 10:00 am in office of Manager Material Management Peshawar Instituteof**

		Cardiology
ITB 22.1	Time, date, and place for bid opening.	**11:30 AM Sharp. 13-10-22.** **in office of Manager Material Management** **Peshawar Instituteof Cardiology**
BID EVALUATION		
ITB 23.1	Clarification of Bids	The Procuring agency may ask the Bidder in writing, only for clarification regarding the received documents in the bid; however, no change in the prices or substance of the bid shall be sought, offered, permitted or entertained. This communication shall be with the prior approval of chairman T&E committee.
ITB 25.3	Criteria for bid evaluation.	**Merit Point Evaluation** The bidder ranked highest in merit points (obtained through and based on technical and financial evaluation) will get central Contract. 70:30 70 technical Marks , (Passing 49 marks) 30 Financial Marks
ITB 25.4 (a) **ITB 25.4 (b)**	One option only. Delivery schedule. Relevant parameters in accordance with option selected:	Not Applicable
Option (i) **Option (ii)** **Option (iii)**	adjustment expressed as a percentage, or adjustment expressed in an amount in the currency of bid evaluation, or adjustment expressed in an amount in the currency of bid evaluation,	Not Applicable
ITB 25.4 (c) (ii)	Deviation in payment schedule. Annual interest rate.	Not Applicable
ITB 25.4 (d)	Cost of spare parts.	Not Applicable
ITB 25.4 (e)	Spare parts and after sales service facilities in the Procuring agency's country.	Not Applicable
ITB 25.4 (f)	Operating and maintenance costs.	Not Applicable

ITB 25.4 (g)	Performance and productivity of equipment.	Not Applicable
ITB 25.4 (h)	Details on the evaluation method or reference to the Technical Specifications.	As in section on Technical Evaluation of bids.
ITB 25.4 Alternative	Specify the evaluation factors.	Not Applicable
	Contract Award	
ITB 29.1	Percentage for quantity increase or decrease.	Number of items can be increased and Decreased as per requirement of the PE within permissible limits under the rules.

Notes on the Special Conditions of Contract

Similar to the Bid Data Sheet in Section II, the clauses in this Section are intended to assist the Procuring agency in providing contract-specific information in relation to corresponding clauses in the General Conditions of Contract.

The provisions of Section III complement the General Conditions of Contract included in Part one, Section II, specifying contractual requirements linked to the special circumstances of the Procuring agency, the Procuring agency's country, the sector, and the Goods purchased. In preparing Section III, the following aspects should be checked:

a. Information that complements provisions of Part One Section II must be incorporated.

b. Amendments and/or supplements to provisions of Part One Section II, as necessitated by thecircumstances of the specific purchase, must also be incorporated.

Table of clauses

SPECIAL CONDITIONS OF CONTRACT

The following Special Conditions of Contract shall supplement & qualify the General Conditions of Contract (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the General Conditions of Contract.
The corresponding clause number of the GCC is indicated in parentheses.

GCC Ref No		
1. DEFINITIONS	1.1 g	**The Procuring agency is:** Peshawar Institute of Cardiology Medical Teaching Institution Peshawar
	1.1 h	**The Procuring agency's country is:** Pakistan
	1.1 i	**The Supplier is:** i. Firm/company/Authorized Dealers registered with relevant sales and income tax authorities and reflected on the active Tax payer list (ATL) of FBR and have requisite qualification and eligibility for supply of Goods in the specialized categories of health sector;and
	1.1 j	**The Project Site is:** Peshawar Institute of Cardiology
3. COUNTRY OF ORIGIN		All Equipment supplied under the Contract shall have their origin in the countries and territories eligible under Contract. All countries and territories as indicated in Part Two Section.VI of the bidding documents Eligibility for the Provisions of Goods, Works, and Services in Government-Financed Procurement. The bidder will provide the details regarding country of origin, Model, Make, manufacturer, along with details of Manufacturing Units and mode of supply, shipment, and any other associated details of the component items and that of the quoted equipment. Bidders are bound to supply the equipment from quoted country of origin only. For purposes of this Clause "origin" means the place where the Equipment were manufactured
7. PERFORMANCE SECURITY	7.1	The Supplier shall, within 14 days of receipt of Award Letter, provide a Performance Security for the due performance of the Contract to the amount of ten (10%) of contract price in shape of CDR/or Bank Guarantee, at the option of bidder, in the name of Hospital Director Peshawar Institute of Cardiology from schedule bank of Pakistan; Failure of the successful Bidder to submit the requisite

		performance security or to sign the contract agreement shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security. In that event, the Client may award the contract to the next bidder whose offer is substantially responsive. The proceeds of the Performance Security shall be payable to the Purchaser as compensation for any loss resulting from the Supplier's failure to complete its obligations under the Contract.
8. INSPECTIONS AND TESTS	8.6	The Technical Evaluation shall be conducted by the Technical and Evaluation (T&E) Committee to undertake verification of documents submitted by the bidder/s along with the technical bids as well as to conduct the physical inspection of the various items. (Section-V -Technical Specification of the Part II of these SBDs).
9. PACKING		The Contractor shall provide such packing of the Equipment as is required to prevent their damage or deterioration during transit to their final destination as indicated in the GCC Clause 9. 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 Equipment' final destination and the absence of heavy handling facilities at all points in transit. 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 and, subject to terms and conditions of Contract clause -18, in any subsequent instructions ordered by the Employer.
10. DELIVERY AND DOCUMENTS		Applicable Delivery Mode: Delivered Duty Paid (DDP) as per contract agreement of the Successful bidder with the Procuring Agency. The delivery, loading/unloading and installation will be responsibility of bidder. No charges will be paid additionally in case of penalty or any other charges.

15. WARRANTY	15.1	The Contractor warrants that the Equipment supplied under the Contract are new, unused, of the most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the Contract. The Contractor further warrant that the Equipment supplied under this Contract shall have no defect arising from design, materials or workmanship or from any act or omission of the Contractor and. Or manufacturer, that may develop under normal use of the supplied Equipment in the conditions obtaining in Pakistan. 1 year after issuance of substantial Completion Certificate by Engineer.
	15.4	The period for correction of defects in the free warranty period is two weeks, including all incidental charges
16. PAYMENT	16.1	The payment will be made as per term and condition mentioned below.
17. PRICES	17.1	Prices charged by the Contractor for Equipment delivered and Services performed under the Contract shall not vary from the prices quoted by the Contractor in his Tender until completion of entire works.
23. LIQUIDATED DAMAGES		As in relevant clauses of the Contract Agreement signed by the Contractor with the Procuring Agency. Penalties shall be imposed as per contract agreement terms and condition section 22 and blacklisting & debarment guidelines of the department if the firm deviates from Rate Contract Agreement.
Contract Award	27.3	The Contractor shall employ and engage trained and skilled staff (within 07 days of the award of contract) reasonably required to complete the duties of this contract to the satisfaction of Peshawar institute of Cardiology PIC-MTI.
28. RESOLUTION OF DISPUTES		The dispute resolution mechanism to be applied will be pursuant to relevant clauses of Contract Agreement signed by Supplier with the Procuring Agency under KPPRA Regime.If at all required, the jurisdiction of Court shall be of Peshawar, Khyber Pakhtunkhwa. **Bid Tie.** In case of tie in the final score of two bidders, and unless otherwise not in contradiction to any of the terms & conditions and specifications of that item, the contract will be offered to the bidder having higher score in its technical bid and the same will be declared as highest

29. GOVERNING LANGUAGE	29.1	The Governing Language shall be: English
30. APPLICABLE LAW	30.1	The Contract shall be interpreted in accordance with the laws of Islamic Republic of Pakistan, which includes the following legislation: i. The KPPRA Act 2012 ii. The KPPRA Rules 2014 iii. The Contract Laws iv. The General Financial Rules of the Govt. of Khyber Pakhtunkhwa and all the v. Relevant laws, rules and regulations pertaining to
Commencement of project	31.1	Within 15 (fifteen) days from the date of singing of contract agreement
		budgeting & financial management of public fund vi. The Bonded Labor System (Abolition) Act of 1992 vii. vii. The Factories Act 1934
31. NOTICES	31.1	**Procuring Agency address for notice purposes**: Hospital Director Peshawar Institute of Cardiology, MTI Plot No.5-A, Sector B-3, Phase-V, Hayatabad, Peshawar – Pakistan. nayamat.shah@pic.edu.pk Manager Material Management murtaza.ahmad@pic.edu.pk **Supplier's address for notice purposes:** As mentioned in their bidding document
32. Duties & Taxes	32.1	The price quoted by the bidder shall be: inclusive of all applicable duties and taxes. All prices shall include relevant taxes & duties, where applicable. The benefit of exemption from or reduction in the GST or other taxes shall be passed on to the Procuring Agency.
33. Penalty & Delivery		The Penalty on late supply of goods shall be charged as under At the rate of 0.05% of the accepted Contract Value subject to max. of 10% of the said value for every day of delay the works remain uncommented or unfinished beyond the respective dates of commencement and completion and compensation for cancellation of the contract and differential amount due to award of contract to the other contractors.

Section IV. Schedule of Requirements

1. As detailed elsewhere in this document, 4% of bid security of the total bid value of the quoted equipment shall be submitted by each bidder on the total quantity of items for which bid is being submitted. The mode of provision of bid security shall bein accordance with the modalities as laid down in the relevant KPPRA Rules andthese Revised Standard Bidding Documents.
2. (Manufacturer /Authorized Dealers) for procurement of quoted Equipment.
3. All certifications and data/ documents shall be valid. T&E committee will carry out the verifications before award of contract and in case of any fraudulent practice; legal action will be taken against the bidder concerned. Any certificate expires before bid opening will not be consider.
4. Non-Provision of mandatory documents mention in these SBDs shall lead to non-responsive of the firm.
5. Bid document and required documents must be submitted in Hard Tap binding.
6. The order may increase / decrease as per requirement / decision of the procuring entity and in this connection no claim shall be entertained.
7. The Procuring Agency, at any stage of the procurement proceedings, having credible reasons for or prima facie evidence of any defect in Supplier's capacities may requirethe Suppliers to provide information concerning their professional, technical, financial, legal or managerial competence.
8. The Procuring Agency has the right to inspect the premises of bidder to inspect the setups ensuring proper after sales services, documents mentioned in technical bids and any other relevant details. Premises (office/workshop) of bidder shall be insured through ownership/or Rent agreement.
9. The Bid security shall be from bank account of the bidder. Ordinary cheque and Payment Order (PO) in the form of bid security shall result in bid rejection.
10. The price quoted by the bidder shall be **inclusive** of all applicable duties and taxes. All prices shall include relevant taxes & duties, where applicable. The benefit of exemption from or reduction in the GST or other taxes shall be passed on to the Procuring Agency.
11. The bidder must be registered with Income / Sales Tax Department, reflected as Active Tax Payer on the list of FBR.
12. In case of the Importers/Authorized Dealers, the firm will ensure that the items are acquired from the original manufacturer and are procured through proper channelas advised by the original manufacturer.
13. The bidder shall provide an undertaking that the bidder has not been declared black listed by any Governmental/ Semi-Governmental institutions.
14. Bidders shall not be eligible to bid if they are under a declaration of Ineligibility for corrupt and fraudulent practices issued by any government

organization inaccordance with the Section 44(1) KPPRA Rules 2014

15. Different models/ prices offered for a single item by the same bidder shall beconsidered as alternate bid and shall be non-responsive.
16. All reservations in SBDs shall be submitted in writing in the pre-bid meeting byauthorized person/representative of the firm.

Evaluation Criteria for Procurement of Medical Equipment

Mandatory Documents

1. The bidder must be registered with Income / Sales Tax Department, and reflected as Active Tax Payer on the list of FBR.
2. Bidder must be (**Manufacturer /Authorized Dealers).**
3. Valid registration with Pakistan Engineering Council (PEC) in specialized field of ME01, ME04 & EE04. (Copy of License to be provided)
4. Detail of At least three (3) similar projects (AHUs and condenser units) successfully completed in last five years. Projects having a minimum capacity of 300 Tons will be considered. (Completion Certificate to be provided).
5. The bidder shall provide an undertaking that the bidder has not been declared black listed by any Governmental/ Semi-Governmental institutions.
6. An Affidavit that the requisite bid security is attached in financial bid without indicating the figure.
7. Integrity Pact

Total Marks (Technical Criteria + Financial Criteria): TM: 70 + 30 =100

(Technical Evaluation Marks: 70)

S #	Parameters	Sub-parameters	Total Marks: 70
1	**Submittal Compliance**		**30**
		Detailed Submittal compliance with Technical Specifications, Equipment Schedules as per BSD a) Air Handling Units (AHU) b) Matching Condensers c) Design Proposed Drawing d) BMS & Temperature Control. The bidder must quote/submit all the above technical submittal.	**10** **10** **5** **5**
2	**Experience**		**18**
	Similar Experience	Detail of similar projects (HVAC System) successfully completed in last five years. Projects having a minimum capacity of 300 Tons will be considered. **(Completion Certificate of each project to be provided along with work order**.) (Each project contain 3 marks) max 6 project	18
6	**Financial Capabilities**		9
		Average Annual Turn Over (for Last 3 years) shall be Rs.500 Million or above. (Audit Report duly signed by externalAuditor (from charted accountant)	3
		Sales Tax (Last 2 Year)	2
		Income tax (Last 2 year)	2
		Firm registered with Security and Exchange Commission of Pakistan (SECP)	2
7	**Technical Staff**		6
		Graduate Mechanical Engineers (03 No), Registered with PEC Graduate Electrical Engineers (03 No.), Registered with PEC ➢ PEC Registration Certificates to be provided ➢ Affidavit of Employment to be provided (one marks for each engineer)	3 3

8	**Networking and Training**		**2**
	Supplier's office for maintenance and 24/7 support	Availability of workshop in Peshawar to be verified with Ownership / Rent Agreement with Owner / RentAgreement with Company Name.	1
		Availability of workshop at National level to be verified with Ownership / Rent Agreement with Owner/ Rent Agreement with Company Name.	1
9	**Additional Warranty**		**5**
		The bidder will be given additional 5 mark for 1 addition year warranty.	5

Total Marks in Technical Criteria: **70**
Qualifying Percentage in Technical Criteria: **70%**
Qualifying Marks: **49**

Financial Criteria (30 Marks):

S #	Parameters	Sub-Parameters	Total Marks: 30
	Price		**30**
		Lowest Price will get full marks. The formula to calculate the marks for the price submitted is: [Lowest Price (Fm)/Price of Bid under consideration (F)] x100 x 0.30	30

Total Marks (Technical Criteria + Financial Criteria): 100

The bidders achieving a minimum of **49** marks (i.e., 70%) out of **70** marks in the Technical Evaluation will be declared technically qualified. Financial bids of only technically qualified bidders will be opened publicly at the time to be announced by the Procuring Agency. The Financial Bids of technically disqualified bidders will be returned un-opened to the respective Bidders. After getting the financial score from the remaining **30** marks, the two scores will be combined to identify the highest ranking fair bid firm.

Merit Point Evaluation Methodology: Contract will be awarded to the highest ranking fair bid firm which gets the maximum marks and becomes the highest ranking in the Combined Evaluation calculated through the Merit Point Average Methodology which puts greater emphasis on non-price factors like meeting the required technical specifications, experience, financial capabilities , technical staff, provision of maintenance & services etc. The following weightages will be givento the technical and financial scores:
Technical Score: 70
Financial Score: 30

Statement of Requirement with Specification

TECHNICAL SPECIFICATIONS

1. GENERAL

1.1. All equipment shall be of such overall dimensions, operating weights service area requirements and configuration that it can be located where shown on the plans without any adverse effect on its performance and clearance requirements. Electrical input KW shall not exceed KW listed in Schedules. Any change in other trades work, anticipated by offering alternate equipment shall be estimated by the Contractor and its cost shall be included in the quoted price for HVAC works.

1.2. All equipment supplied under this section shall be brand-new, factory manufactured and factory assembled and complete in all respects. The type, characteristics, capacity rating, component sections of all equipment **(Annexure-B)** shall be as scheduled in the drawings **(Annexure-A).**

1.3. All equipment furnished by the contractor shall include vibration isolation mounting, pads, anchors bolts frames or any other mounting or supporting accessories.

1.4. All power driven equipment shall include motor drives, and motor foundation bases and accessories.

2. MEDICAL GRADE HYGIENE TYPE AIR HANDLING UNITS

2.1 General

AHUs shall be factory assembled packaged air handling units, of capacities and characteristics as scheduled of equipment **(Annexure-B)** and shown on the Drawings **(Annexure-A).** Air Handling Units shall be vertical or horizontal type with components as scheduled of equipment **(Annexure-B)** and as shown on Drawings **(Annexure-A).**.

AHUs shall be hygienic certified from reputable institute.

Units shall be of such overall dimensions, weight, service and requirements, configuration, so that these may be located where shown.

Same coil shall be used for cooling or heating and coils shall be of non-ferrous construction with mechanically bonded smooth aluminum fins, suitable for chilled water/hot water application.

The Air Handling Units shall be DOUBLE SKIN HYGINENE type of make as specified. The Units shall comply with the requirement of DIN 1946-4: 2018, VDI-6022-1:2018, inclusive of the following additional features:

- Smooth joint/connection between bottom, side panels and top.
- Removable fan and for easy cleaning fan casing.

- Marine Light AC and sight glass in certain section for easy inspection.
- All joints shall be sealed with silicone rubber.
- Air tight dampers.
- All material used in the AHUs shall be resistant to Disinfectant.

Air handling units shall be supplied factory assembled. The Air Handlers shall be low pressure or high-pressure single zone draw through type as indicated on be equipment schedule. The Units shall be complete with Coil section with cooling/heating coils, blower section with blower, pulleys, V belts and electric motor, Pre-filter section with Pre-filters 50mm panel filters class EU3, Secondary filter section with secondary filters 90% efficiency class EU9, access doors where ever required, volume dampers, stainless steel drain pan and any other appurtenances necessary for satisfactory operation.

The Air Handing Unit shall be installed in the following sequence:

- Volume Dampers for Fresh Air and Return Air.
- Pre- Filter Section with Panel Filters Class EU-3, preferably Aluminum washable type Panel Filters 50mm thick.
- Coil Section with cooling/Heating coils with stainless steel drain pan.
- Blower section with blower, pulleys, belts and electric motor.
- Secondary filter Section with Secondary bag filters class EU-9.

The Air Handing Units shall be horizontal / Vertical discharge type as mentioned in the equipment schedule. The air volume, cooling / heating capacity, external static pressure and coil conditions shall be as mentioned in the schedules.

2.2 Frame design

2.2.1 Frame made of extruded aluminum profile with solid plastic corner connection. The frame structure of the unit shall consist of one or more section. The maximum overall length of each section shall not exceed 3000mm. Each section shall have bolted construction and shall have permanently elastic and non-ageing plastic seal between them to ensure the tightness of the casing.

2.3 Panel casing

2.3.1 The Panels shall be double skinned, minimum 50mm thick, made of 1.0 mm thick external galvanized powder coated steel sheet and inside 0.8 mm Stainless Steel Sheet, smooth surface, with insulation, non-combustible type.

The heat insulation value of the panels shall not exceed 0.84 Wm2/K for 50mm panel. The

sound transmission loss shall be according to DIN 52210.

2.4. Fans

The fan shall be fully enclosed centrifugal, single width inlet, or double width double inlet, removable for easy cleaning, suitable for the design system pressure. The fan shall be capable of discharging the required volume of air against the duct work systems resistance plus the resistance through the unit itself. The contractor shall add the resistance through the unit to the external static pressure indicated in the schedule. Fan blades shall be backward curved design. The fan shaft shall be of steel, accurately finished, mounted with fan housing, and shall have bearings at both ends. Impeller wheel shall be of non over loading type, rigidly constructed, statically and dynamically balanced and shall be free from objectionable noise or vibration.

2.5 Electric Motors

The electric motor should be of the type and size as specified for driving Air Conditioning equipment and should comply with the rules of Electrical Machines as stated in VDE 0530/ 59. Generally, all motors shall be of single speed, three phase, 50 cycle, squirrel cage induction type unless otherwise specifically noted. The motor should be able to give rated output at +5% of voltage and frequency variation. The motor where specified single phase should be suitable for operation on 220v, 1 ph., 50 cy, and where specified three phase, it shall be 380v 3 Ph., 50 Cy. All motors shall arrange for quite operation and guaranteed to give required output, to fulfill the requirement of the machinery without producing any audible sound outside the machine room.

3.6 Coils

a) Chilled Water Coils

The coils shall be combination type (Cooling / Heating,) seamless copper tubes expanded into aluminum fins. Coils shall comply the Related Standards; DIN EN 13053, DIN 1946-4, VDI 3803-1, VDI 6022-1. The fin distance should not be less than 2.0 mm between fins. Fins material shall be aluminum and shall have epoxy coating. The tubes shall be correctly circulated for desired velocity of water and the pressure drop across the coil should not exceed 60 Kpa. The coil shall be removable type for easy cleaning. Each coil shall be suitable for working pressure of 10 Bars and 60C. The Air velocity across the AHU coil at the designed Air Volume shall not exceed 2.8 meter per second.

a) **DX-Coils**

Additionally, the AHUs shall be provided with DX-Coil section with DX coil of capacity as mentioned in the equipment schedules to be connected with the matching Air Cooled Condensing unit as specified. Coils shall comply the Related Standards; DIN EN 13053, DIN 1946-4, VDI 3803-1, VDI 6022-1. The fin distance should not be less than 2.0 mm between fins. Fins material shall be aluminum and shall have epoxy coating.

2.6 **Secondary Filter Section**

Secondary filter section shall be provided to accommodate secondary bag filters of class EU9 and

EU7 as specified in the equipment schedules. Marine light and sight glass shall be provided for easy inspection of the filter conditions. The size of the filter section shall be such that air velocity does not exceed 2.8 meters per second. Access door shall be provided at one side of AHU in filter sections and fan section.

2.7 **Pre-Filter Section**

Pre-filter section shall be provided; such that filter velocity is in accordance with the velocity specified in the equipment schedules. Access to the filter shall be provided either side. Filter shall fit snugly to prevent air by-pass, in the filter frame. Inspection light shall be provided with sight glass.

2.8 **Mixing Boxes with Air Dampers**

Air handling units shall be provided with mixing boxes (if mentioned in schedules) having return air and outside air inlets. The mixing boxes shall have sufficient size to facilitate the proper mixing of the return and outside airs.

Air dampers shall have opposed airfoil blades, rotating in nylon bushes via glass reinforced nylon gears. Blades material shall be Aluminum type. Blade length shall be sectionalized to not more than 48 inch (1200mm).

Soft plastic profiles at the edges of the blades shall be provided to assure tight closure of dampers. Dampers shall be inter-linked with galvanized steel pivot rod.

2.9 **Condensate Drain Pan**

A condensate drain pan shall be made of SS (Stainless Steel) material and Insulation to comply with NFPA-90A Standard.

2.10 **Matching Condensing Unit**

The condensing units shall be composed of compressors matching capacity with respective DX-coil, condenser coil, fans, refrigerant piping and electrical component and etc, enclosed in a cabinet. The unit shall be factory assembled, internally wired, refrigerant charged with R407C and shall be matching / suitable for use to the DX- coil of the indoor air handling unit, The unit should be capable to operate at 115 F ambient temperature and shall be selected at Saturation Suction Temperature of 44 F.

The compressors shall be fully accessible, hermetic scroll type equipped with oil pump, refrigerant gas cooled motor, preset internal relief valve, inherent thermistor motor protection and suction service valve.

The coils shall be air cooled with constructed of seamless copper tubes mechanically bonded to aluminum fins with maximum 12 fins per inch. The coils should be tested for 400 psig. The unit shall be furnished with direct driven propeller fans discharging air upward. The fans shall have permanently lubricated bearings and inherent corrosion resistance shaft. The manufacturer shall statically and dynamically balance each fan and the fan shall be provided with non-corrosive fan

guard. The fan motor shall be totally enclosed and wired to the unit control panel.

The unit casing shall be made of zinc coated galvanized sheet steel, Exterior surfaces shall be cleaned, phosphatized and finished with a polyester powder painting and weather-resistant baked enamel finish. Unit's surface shall test 500 hours in salt spray test. Units shall have removable end panels, which allow access to all major components and controls.
The unit shall have control panel, factory wired and shall contain individual electrical components, contactors, overload relays, anti-recycling time delay relay, control circuit disconnect switches, power and control terminal block complete in all respect to operate and maintain indoor AHU having DX-coil.

3 STEAM HUMIDIFIERS

Humidifiers shall be self-contained electric resistance heated type, steam humidifier of capacities as given in equipment schedule, and shall be suitable for unit and/or duct installation. The unit shall consist of an evaporating chamber with gasket. Cylinder shall be cleanable PVC type. Water Make-up valve shall be solenoid operated, brass body type. A cleanable strainer with, fine mesh screen shall be mounted upstream of valve. Steam dispersion U-Tubes shall be of 304 stainless steel. U-tubes shall be fitted with properly spaced and sized removable press fit brass orifices which shall be varied in size to provide uniform steam flow. Combination low water cut off and water make up valve controller shall be of the electrode probe type. The humidifier shall utilize an adjustable surface skimmer arranged so that on each refill cycle, a portion of the humidifier water will flow to drain. The chamber shall be provided with a bolted cover, clean out opening in the front face, for periodic removal of loose scale, factory fitted, and shall contain magnetic contactors, control circuit transformer, logic control system module numbered terminal strip and all interconnecting wiring Control Module shall be solid state and shall provide for automatic refill, automatic-reset, low water cut off and manual surface flushing through the surface skimmer.

4 RE-HEAT LECTRICAL COIL

4.1 Heater elements shall be of resistance wire coil or Tube type supported in a metal frame and furnished with terminal box, thermal cut-out device with manual rest button, 3-pole contractors, and control transformer.

4.2 Re-heat electric coil shall be designed to deliver the specified KW output shown on the drawings **(Annexure-A).** at a nominal operating voltage as scheduled. The connections, to the elements shall be made by an approved stud-type projection.

4.3 Each heater shall be furnished complete with all necessary wiring or manual reset button, heater elements, and transformer carried to a terminal box integral with unit. Heater circuits shall provide balanced 3-phase condition when energized. Heater shall be furnished with a rust-resistant and heat resistant paint on metallic finish. Heating elements and insulated connections shall be corrosion resistant and shall be impervious to moisture.

5 FANS

5.1 The Contractor shall furnish and install ventilation and exhaust fans of the type and capacity as specified in **Annexure-B** and shown on the drawings **(Annexure-A)**. The Contractor shall be responsible for the proper selection of the fans so that the specified operating conditions are obtained. Motors shall be sized to provide the required Bhp for meeting the specified conditions without overloading.

5.2 The fans shall be statically and dynamically assembled and tested in the factory. The fan-motor set shall be selected for quiet operation. The bearings may be ball or roller type but must be silent running, heavy duty, self-aligned type, and to prevent leakage of oil or grease, preferably sealed and permanently lubricated otherwise, requiring only yearly lubrication with oil or grease cups provided in easily accessible positions.

5.3 Fans used for exhaust shall be provided with auto closing louvers and rain protection hood of louvers as specified on the exhaust side.

5.4 All fans shall be mounted on a rubber-in-shear or spring type vibration isolators, so that the fan shall not transmit vibration to the building structure.

5.5 All the outdoor installed fans shall has weather proof construction and fan motors shall be provided with rain protected canopy.

5.6 **Propeller Fans**

The propeller fan shall be direct driven by totally enclosed fan motors and shall be rigidly constructed and shall be free from objectionable noises and vibrations. Sealed, permanently lubricated ball or roller bearings shall be provided. Propeller fans shall be provided with self-closing louvers installed on the building wall.

5.7 **Centrifugal Fans**

The Centrifugal Fan shall be forward or backward curved or air-foil type as scheduled, complete with housing motor drive equipment, supports, vibration isolators and inertia base. The housing shall be heavy gauge steel suitable braced to provide stiffness to housing and rigid supports for bearings. Bearings shall be selected for 60,000 hours' minimum life

based on continuous operation

5.8 **Duct In-line Centrifugal Fans**

The contractor shall furnish and install duct mounted inline exhaust air fans where shown on the drawings **(Annexure-A).** of capacity in **Annexure-B** and characteristics as schedule. The in-line fans shall be direct driven or belt driven centrifugal type light weight compact units.

Fan housing shall be galvanized steel skin securely attached to a galvanized steel frame work. Easy access to motor, impeller and bearing for inspection and repair through the door at the side of the fan should be provided. Inlet venture to be precision spun wheel is to have backward inclined blades designed for maximum efficiency and is to be dynamically balanced with permanently affixed balance weights. Motors shall be open drip-proof type of the voltage and phase as schedule

6 SHEET METAL DUCTING

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

6.2 The Contractor shall make shop drawings in (Annexure-A) of all ductwork and the same shall include details of all splitters, takeoffs, vanes, dampers, elbows an all other necessary fittings required for the proper operation of the air system. Drawings and other details shall be submitted to the Engineer Incharge for approval before fabrication.

6.3 Exact dimensions and locations of diffusers, registers and grilles shall be, submitted to the Consultants for approval, otherwise any changes directed after installation shall be made without additional cost. For diffusers and registers adequate provision shall be made in the neck connections for installation of deflectors and dampers.

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

6.5 All ducts passing through walls shall have 20 gauge G.I. sheet sleeves, extending 1/4" beyond the finished face of the wall both sides. The sleeves shall be of sufficient size to cover duct insulation or any other duct covering and allow at least 1/8" clearance in the sleeve for free movement of the ducting. The Contractor shall be responsible for supplying, locating and setting of all necessary duct sleeves.

6.6 All sheet metal ductwork shall be fabricated from commercial quality prime finish galvanized

steel sheet. The steel sheet shall be according to ASTM designation A525 & A90 and zinc coating according to G60 ~ G30 (0.6oz ~ 0.3oz per 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 of the zinc coating.

6.7 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 flaking shall project inside the ducting.

6.8 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 less than 30 inches, shall be constructed of not more than eight feet sections.

6.9 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 reverted 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 which 40”- 60” shall have one and over 60” shall have two single curved square elbows shall be 3 inches.

6.9.1 All ducts to be machine made with Flanged joints, Angle Iron to be anodized/ painted with red-oxide (2 coats) and silver coated. Proper sealant/ gas-kits to be used. duct work to be constructed as per SMACNA low velocity duct construction standards. Turning vanes and sound liners to be provided where required to reduce noise level.

6.10 The supply and return air duct connections with the fans and equipment shall be made through heavy duty air tight at least 8 oz. weight canvas flexible connection at least 6” wide to prevent transmission of vibrations. The canvas collar shall be properly sewn and clamped at both ends.

6.11 The ducts shall be adequately supported from hangers firmly fixed and generally suspended from the building structure with the help of concrete inserts, 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 1-1/4” and 1/4” M.S. flat or 1” x 1/8” angle for ducts upto 12” wide. 1-1/4” x 1/8” angle Upto 30” width, 1-1/2”) 1/8” angle upto 72” width and 2” x 3/16” angle upto 96” width. Hangers shall be spaced on average 10

feet centers with a hanger no further than 1 ft. on each side of any changes or direction. Ducting passing through building expansion joints shall be supported on either side of the joint. The hangers for horizontal ducts shall be 3/8" round rods for ducts upto 30" wide. 1/2" round rods or 1-1/2" x 1/8" M.S. flat upto 72" width and 1-1/2" x 3/16" 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 of M.S. flat straps riveted with the duct. Perforated band or wire shall not be used in any case for supporting ducts.

6.12 The ducting shall be fabricated according to the following schedule:

Rectangular Ducting	
to 12" larger dimension	26 gauge
13" - 30" "	24 "
31" - 54" "	22 "
55" - 84" "	20 "
85" to above "	18 "

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

(a) Longitudinal:
Pittsburgh lock, double seam, or grooved seam.

(b) Circumferential:

Duct larger dimension to 23"	Drive slip
24" - 42"	1" high pocket lock or standing seam
43" - 72"	1-1/2" high pocket lock standing seam.

6.14 The bracing for ducting shall be as follows:

Duct larger dimension	Size of bracing M.S. angle
To 23"	None
24" - 30"	Joints at 4" centers without bracing or joints at 8" centers with 1" x 1" x 1/8" bracing between joints.
31" - 42"	1" x 1" x 1/8" at 4' centers
43" - 72"	1-1/2" x 1-1/2" x 1/8" at 4' centers

The bracing shall be carried around all four sides and riveted with the ducts at maximum 6" centers.

6.15 Special joints, bracing and hangers, as specified by the Consultants, shall be used for ducts with larger dimension over 96".

7 DUCT FLEXIBLE CONNECTION

Flame proof flexible connections shall be furnished and installed on all suction and discharge connections of fans and air-conditioning units for presentation of transmission of vibration through the ducts to occupy spaces.

Flexible connections also be provided wherever ducts cross building expansion joints. Flexible connections shall be factory fabricated from Cotton Cloth as specified above or chemically impregnated canvas if approved by the Engineer. Connections shall fit closely and are to be secured in an airtight fashion at connections to ductwork, fans and apparatus. The unclamped section of the flexible connection between apparatus and ductwork shall not be less than 150mm (6 in.) in length. Flexible connections shall not be painted or insulated. Samples of the material shall be presented to the Engineer for approval before installation.

8 AIR DAMPERS

8.1 Furnish and install all dampers of the specified capacities (annexure-B) and sizes as shown on the drawings **(Annexure-A)**, complete in all respects.

8.2 All dampers shall be of rigid construction, free of vibration, balanced, and control air volume properly.

8.3 Splitter dampers shall be fabricated of sheet metal, two gauges heavier than the duct gauge in which the damper is installed. Damper shall be fabricated of wood of an aero foil shape, over which sheet metal shall be formed to completely cover the wood. Damper shall be operated by a 3/16-inch rod brought through the side of the duct with brass locking set-screw and bushing. Bushing shall be of thickness equal to the thickness of the duct insulation. Locking set screw shall be 1/4", arranged for easy locking of the damper operator at the desired position. Damper shall be installed with full length hinge. Rubber gaskets shall be installed to minimize air leakage. Damper operator shall be galvanized and shall be designed for convenience of operation.

8.4 Quadrant volume damper shall be multi-leaf, opposed blade type/ parallel blade type, with a maximum blade width of 8 inches. Damper shall be constructed of sheet metal, two

gauges' quadrant operators manufactured of brass. Operators shall be provided with stand off mountings on thermally insulated ducts to provide clearance between the duct surface and operator, equal to the thickness of the insulation. Quadrant operator shall be heavy duty, capable of being locked at desired position conveniently. Dampers, after fabrication, shall be provided with a baked enamel finish.

8.5 Duct test holes, with patches or threaded plugs in ducts and plenums, shall be provided, where directed or necessary, for using pitot tubes for taking air measurement to balance the air systems. At each of these locations where ducts or plenums are insulated, extensions shall be provided with plug fittings.

8.6 All dampers shall be of approved quality to meet the Consultant's satisfaction.

9 AIR INLETS/OUTLETS

9.1 Furnish where shown on drawings (annexure-A), all grilles, registers and louvers of sizes, capacities and types as specified.

9.2 The Contractor shall check and confirm with the air devices manufacturer that proposed, grilles and registers should meet the capacity and "throw" requirements, without draft, dead spots and noise.

9.3 All air devices shall have a sponge rubber gasket around the perimeter for tight fit against adjoining structure.

9.4 All wall type supply air grilles and registers shall have horizontal and vertical adjustable deflecting bars, and registers shall also have opposed blade volume control dampers, adjustable from face with a removable key. Registers and grilles shall have a minimum of 75% free area.

9.5 All return grilles shall be of the fixed bar type to match supply out lets and have a minimum of 75% free area. Return air registers, with opposed blade volume control dampers, adjustable from the face, one to be fixed where shown on the drawings (annexure-A).

9.6 All air devices shall be thoroughly cleaned, given anti-corrosion chemical treatment, one coat of acrylic melamine based baked primer and finished with anticorrosion and weather resistant acrylic-melamine plain or styrenated alkyd hammer baked enamel paint of approved colour.

9.7 Fresh air intake and exhaust discharge louver shall be fixed where shown on drawings (annexure-A). These louvers shall be of fixed blades, angled to provide adequate weather protection and a free area of not less than 70%. They should be constructed, unless otherwise specified, of aluminum with vertical supports as necessary to ensure complete

rigidity.

9.8 All louvers and bell mouth shall be fitted with aluminum mesh bird and anti-vermin Screens

9.9 Registers and grilles on sides-walls shall be fixed on approved wooden frames. Perfect alignment and symmetry shall be maintained.

9.10 Unless otherwise specified, all grilles, registers and louvers shall be of , local manufacture of approved design and quality

10 DUCT THERMAL INSULATION

10.1 No insulation shall be applied to any ductwork, or to any surface, until all foreign matter has been removed from the surfaces to be installed. All insulation shall be applied in a manner consistent with good practice and methods.

10.2 Insulation shall be continuous through floors, walls, partitions, etc. except when otherwise indicated or specified. Where space will not permit application of insulation in wall or slab chase, the chase will be packed full or 85% magnesia mineral wool, asbestos rope, or fiber-glass and protected with cover plates, as approved by the Engineer/Consultants.

10.3 Ducts shall be insulated with 1-inch-thick fiber glass insulation of 16 Kg/m3 for Indoor Installed Duct and 2-inch-thick fiber glass insulation of 24 Kg/m3 for outdoor Installed Duct, thermal conductivity of 0.035 W/m Deg C at 24 Deg C. The insulation shall be protected with 8oz canvas.

10.4 External and weather exposed insulated ducting shall be insulated as specified and then protected with a jacket of 45 lbs. roofing felt, all joints sealed with hot bitumen PBS PB4 or approved equal. The jacket shall be further mechanically secured to the duct with 1/4" wide soft aluminum bends, generally spaced at 450mm in indigenous coarse cloth. Canvas roofing felt and asphalt impregnated draft paper or approved quality is to be used.

11.0 SOUND LINER

11.1 Sound liner shall be high efficient acoustic material produced from strong resilient glass fibers firmly bounded together with a thermosetting resin. Liner material shall be faced with a black, strong, durable, dimensionally stable woven glass fabric and shall have the capability to achieve zero percent fiber migration and also have the capability to withstand an air velocity of 5000 FPM without de-lamination or erosion. Sound liner must have a thickness not less than 1 inch and having density 1.5 lbs./cu. ft. and thermal conductivity value not exceeding 0.27 Btu/hr. sq. ft. per inch at 75 0F.

11.2 The lining shall be applied in cut-to-size pieces attached to the interior of the duct with fire-resistant adhesive. Top and bottom pieces shall lap the side pieces and in addition shall be

secured with welded pins, adhered clips, metal, nylon or high impact plastic, on maximum 12 inch centers. Welded pins, or adhered clips shall not distort the duct, burn through or mar the finish or the surface of the duct. Pins and washers shall be flush with the surface of the duct liner and all breaks and punctures of the duct lining coating shall be sealed with fire-resistant adhesive. All exposed edges of the liner at the duct ends and at other joints where the lining will be subject to erosion shall be coated with a heavy brush coat of fire-resistant adhesive, to prevent de-lamination of the glass fibers.

12 PIPING, HANGERS AND SUPPORTS

12.1 All piping shall be properly supported or suspended on stands, clamps, hangers, etc. of approved design. Supports shall be designed to permit free expansion and construction while minimizing vibration. Pipes shall be anchored while minimizing vibration. Pipes shall be anchored, where shown or where directed by means of steel clamps securely fastened to the pipe and rigidly attached to the building construction.

12.2 Screw threads shall be cut clean and true, screw joints made tight without caulking and without red or white lead. No bushing shall be used to change pipe size. Reductions to be made with eccentric reducers or eccentric fittings. All pipes 2 inches and less shall be reamed out after cutting to remove all burrs.

15.3 The drawings (annexure-A) indicate generally the size and location of piping as designed for space conditions, ceiling heights, etc. and may not be changed until coordinated with other contractors. The pipe work shall conform fully to the following requirements.

12.4 The piping shall be properly graded to secure easy circulation and prevent noise and water hammer. As much pitch as space conditions permit, to the point where vent relief, drip and drain connections are provided. Cap dirt pockets at all riser heels, low points and other places where dirt and state may accumulate. Proper provision for expansion and contraction in all portions of pipe work to prevent under strains on piping or apparatus connected therewith shall be made. Double swing at riser transfer wherever possible to take up expansion shall be provided. Expansion joints and loops where indicated shall be installed.

12.5 Approved screw unions, with steel or bronze bodies and ground brass taper or spherical joints, shall be installed at traps, instruments, etc., and wherever else direction to permit easy connection and disconnection.

12.6 All pipe work shall be so arranged and put together as to prevent undue strains or leaks caused by expansion and contraction. Riser branches and other offsets made up with 4

elbow swings wherever possible. Riser branches arranged to take up motion of risers and mains.

12.7 To meet job conditions, the water supply and return mains shall be set up and down where directed. In any such case, provide drain cocks at low points and vent traps at high points.

12.8 The connection to water supply and return mains shall be made at sides, vertically or at 45 degrees, as shown or directed (generally at 45 degrees). Vent connections at all high points, connected to expansion tank as shown or directed.

12.9 Alterations - If after plant is in operation, any coils do not circulate quickly and noiselessly (due to trapped or air bound connections), the Contractor shall make proper alterations in these defective connections. If connections are concealed in furring, floors or ceilings, he shall bear all expense of tearing up and refinishing construction and finish.

12.10 All piping passing through floor construction shall have No. 20 U.S. gauge galvanized irons sleeves the full depth of the floor construction. Any sleeves in wet areas, such as equipment rooms, shall extend 1 inch from floor thickness, and space between pipe and sleeve shall be caulked water tight.

12.11 Visible piping passing through finished floors and ceilings shall be provided with escutcheons. Escutcheons shall be bell shaped, with plated finish and shall be fastened to pipe.

12.12 Sleeves for exposed horizontal pipes passing through partitions shall be galvanized steel pipe with heavy spun metal, and set-screwed to the pipe on each side of partition.

12.13 All sleeves shall be of sufficient size to include pipe covering.

12.14 All sleeves shall be furnished, located and set up by the Contractor and he shall be responsible for the accuracy of their location when concrete is poured.

12.15 Piping or ductwork passing through water proof construction will be counter flashed.

12.16 Any piping run underground shall be painted with two heavy coats of asphaltum paint.

Service	Material	Type	Weight

Chilled/Hot water	Mild Steel	Black Seamless	Schedule 40
Condenser water	Mild Steel	Black Seamless	Schedule 40
Drains (Risers & Mains)	Mild Steel	Galvanized	Schedule 40
Drains (Branches)	Mild Steel	Galvanized	Medium

12.17 Provide suitable and substantial hangers and supports for all horizontal piping. Piping shall be carried by pipe hangers supported from concrete inserts. In general, supports for pipes shall be not more than 10 feet apart for 4 inches and larger pipes, and not more than 8 feet apart for 3 inches and smaller according to the conditions of the job.

12.18 The Contractor shall furnish and set all concrete inserts and shall be responsible for such inserts being in place when concrete is poured. Inserts shall be of approved quality and shall be constructed of malleable iron and shall have space for rods of all sizes. On all inserts for pipes 3 inches reinforcing rods of 5/8-inch diameter through the slot shall be provided for this purpose.

12.19 All concrete inserts shall be placed in forms, in ample time to permit the Contractor for the general construction to perform his work on scheduled time. All vertical piping shall be supported by heavy pipe clamps resting on the building construction.

12.20 Piping shall be hung from other piping. Piping shall be supported from the building structure. Hangers shall be of heavy construction, suitable for the size of pipe to be supported. All materials shall be wrought malleable iron. Hangers for pipe up to and including 5-inch size shall be swivel ring, split ring or adjustable celeries type. Hangers for larger pipes shall consist of two rods and cross rod.

12.21 Hangers for insulated piping shall support the pipe without piercing the insulation. Cold, insulated pipes shall be provided with a section of work on each hanger insulation. Hot, insulated pipes shall be provided with wood saddles at each hanger.

12.22 The contractor shall provide manufacturer's catalogues and literature as applicable.

12.23 All ceiling hung equipment shall be hung from ceiling (concrete slab) and shall not rest on false ceiling.

13 VALVES AND FITTINGS

13.1 Hand valves and check valves shall be furnished and installed as shown on the drawings (annexure-A), required or directed.

13.2 All valves for balancing service in pump discharge AHUs and as so noted on the drawings (annexure-A) shall be of Circuit Setter type.

13.3 Check valves in horizontal position shall be 150 deg swings, check valves in vertical position and pump discharges shall be balanced check valves of the low pressure drop type.

13.4 Provide all necessary manual or automatic vent valves, drain valves, in equipment rooms more than 6 feet above floor.

13.5 Furnish and install all other hand valves, check valves, cock, etc., as required for the complete and proper valves of the entire installation as defined herein.

13.6 Chilled water piping connections to air conditioning units shall include all necessary gate valves, air vent valves, drain connections, lock shield valves and the automatic valves arranged as detailed on the drawings (annexure-A). Lubricated plug cocks may be used in place of lock shield valves, 3 inches and up.

13.7 Inverted ball float traps shall be used for venting water mains at all high points and wherever else required, or as directed. Traps shall be 3/4 inch and of approved quality.

13.8 Drain cocks, with threaded ends for hose connection, shall be provided for any low points in the water and return main, where directed.

13.9 Compression type, key-operated, air cocks shall be furnished and installed where shown and where required for venting. Cocks shall be 1/4 inch in size and shall be of all bronze construction. At least two dozen keys shall be delivered to the owner's representative for operating these cocks.

13.10 All cast iron body valves shall have renewable bronze seat rings and bronze spindles. They shall have the self-packing feature so that they can be packed while open and under pressure.

13.11 Furnish and connect to all valves, except valves at equipment, brass tags, polished or

lacquered with stamped lettering or numbers filled in with black paint. Also furnish a schedule of all valve tags, framed in a polished hardwood frame and covered with plate glass.

13.12 All strainers in water lines shall be y-pattern, set in a horizontal (or vertical downward) run of the pipe. Where this is not feasible, strainers may be of enlarged cross-section flat type. In all cases, strainers shall be arranged so as not to "trap" pipes and to facilitate disconnection and opening up for cleaning.

13.13 All strainers shall have cast iron or bronze bodies of ample strength for the pressure to which they shall be subjected, removable cylindrical or conical screens of nickel, copper or brass, and suitable flanges or tapings to connect with piping they serve. They shall be of such design as to allow blowing out of accumulated dirt and to facilitate removal and replacement of a strainer screen, without disconnection of the main piping.

13.14 Standard features for pipe fittings are given in the table below:

Service	Size	Material	Type	Weight	
Chilled/Hot Water	Upto 2 in.	Cast iron	Screwed	125 Lbs.	
	2.5 in & up	Steel	Welding		Standard
Condenser Water	Upto 2 in.	Cast iron	Screwed	125 Lbs.	
	2.5 in & up	Steel	Welding		Standard
Drains (Steel Pipe)	All	Cast iron	Galvanized	Standard	

13.15 All steel welded elbows shall be of the long radius type, except where conditions do not permit.

13.16 The Contractor has the option of welding steel pipe 2 inches in size or larger. Where welding is used, fitting shall be Tube Turn or as approved. "Weld-0-lets" may be used where fittings of standard sizes are not available, and where authorized. No other type of welded joint is acceptable. All hobs welding shall be by the electric arc welding process in accordance with the following:

(a) All joints 45-degree level type. Pipe mill-beveled or machine-beveled by the Contractor.

(b) All scale and oxide removed with hammer, chisel or tile and bevel left smooth and clean.

(c) Pipe lengths lined up straight with abutting pipe ends concrete.

(d) Both conductors from the welding machine shall be extended to the location at which the work is performed and shall be taped or held together so as to prevent induced currents in structural steel, in piping or in other metals within this building. The ground lead shall be connected to lengths of pipe with suitable clamps in such manner that welding current will not flow through joints in pipe, structural steel of building or steel pipe supports.

(e) Weld metal must be thoroughly fused with base metal at all sections. Welds shall be of sound metal, free from laps, slag inclusions or other defects.

(e) All welders shall be fully qualified and approved for such work.

14 CONDENSATE DRAIN PIPING

14.1 Install drain pipes as and where shown on drawing (annexure-A).

14.2 Drain pipes shall be of Galvanized Iron material medium quality or PVC C- Class type. Fittings shall be of galvanized malleable iron or PVC accordingly.

14.3 Provide supports at every 1-meter and every change in direction.

14.4 Drain pipe shall be installed with proper slope.

14.5 All Condensate drain piping to be terminated to nearest Drain.

14.6 Do not connect drain piping to drainage system. Use indirect connection.

14.7 All pipe passage through walls shall be through suitably sized G.I. pipes to act as a sleeve.

14.8 Drain pipe sizes to be as per manufacturer's recommendations.

15 FLEXIBLE PIPE CONNECTORS

15.1 Flexible connectors shall be provided wherever pipes cross building expansion joints,. These connectors shall be such that the working pressure, temperature and movement encountered will not be more than 75% of that allowable for the joint. One side of joints must have all piping and/or adjacent equipment adequately anchored. The other side must be supported, aligned and guided so as to allow free movement without imposing unnecessary stresses on the joints.

15.2 Connectors shall have integral duck and rubber flanges. They shall have individual solid steel ring reinforced with a carcass of highest grade woven cotton or acceptable

synthetic fiber. Joints shall be constructed to pipeline size and to meet working pressures, conditions and face measurements as designated. They shall be of archetype construction with the number of arches (corrugations) dependent of the projected movement. All joints must be finish-coated with suitable paint to prevent ozone attack. Split back-up (or retaining) rings shall be furnished and fitted.

16 REFRIGERANT PIPING AND FITTINGS

16.1 The drawings (annexure-A) indicate generally the size and location of piping as designed for space conditions, ceiling heights, etc. and must be re-checked in coordination with manufacturer and site condition. Pipe work shall conform fully to the following requirements.

16.2 If after plant is in operation, any coils do not circulate quickly and noiselessly (due to trapped or air bound connections), the Contractor shall make proper alterations in these defective connections. If connections are concealed in furring, floors, or ceilings, he shall bear all expense of tearing up and refinishing construction and finish.

16.3 All piping passing through floor construction shall have No.22 U.S. gauge galvanized iron sleeves the full depth of the floor construction. Any sleeves in wet areas, such as equipment rooms, shall extend 1-inch-thick floor, and space between pipe and sleeve shall be caulked watertight.

16.4 All visible piping passing through finished floors and ceilings shall be provided with escutcheons. Escutcheons shall be bell shaped, with plated finish and shall be fastened to pipe.

16.5 Sleeves for exposed horizontal pipes passing through partitions shall be galvanized steel pipe with heavy spun, metal, and set-screwed to the pipe on each side of partition.

16.6 All sleeves shall be of sufficient size to include pipe covering.

16.7 All sleeves shall be furnished, located and set up by the Contractor and he shall be responsible for the accuracy of their location when concrete is poured.

16.8 The Contractor shall furnish and set all concrete inserts and shall be responsible for such inserts being in place when concrete is poured. Inserts shall be of approved quality and shall be constructed of malleable iron and shall have space for rods of all sizes. On all inserts

for pipes 3 inches and larger in size, the Contractor shall insert reinforcing rods 5/8-inch diameter through the slot provided for this purpose, and shall be responsible for its being in place when concrete is poured.

16.9 All concrete inserts shall be placed in forms, in ample time to permit the Contractor for general construction to perform his work on scheduled time.

16.10 All vertical piping shall be supported by heavy pipe clamps resting on the building construction.

16.11 No piping shall be hung from other piping. Piping shall be supported from the building structure. Hangers shall be of heavy construction, suitable for the size of pipe to be supported. All materials, except rollers, shall be wrought malleable iron. Hangers for pipe Upto and including 5-inch size, shall be swivel ring, split ring or adjustable cleaves type. Hangers for larger pipes shall consist of two rods and cross rod with cast iron pipe roll.

Maximum Spacing between Copper Tubing Supports						
NOM. TUBING SIZE - INCH	1/2"	5/8"	7/8"	1-1/8"	1-3/8"	1-5/8"
MAXIMUM SPAN - FEET	5	6	6	7	8	9

16.12 **MATERIALS**

16.12.1 **PIPING**

Copper piping shall be seamless ACR type and shall confirm to ASME-B280. All pipes shall be
I nternally degreased and cleaned.
Upto 5/8" soft 22 gauges
Upto ¾" and above Hard 19 gauge

16.12.2 **FITTING**

Fitting for copper tubing should be conforming to ASME-B16.22 as classified in the pipe material table below: -

Service	Material	Type
Suction line	Wrought or cast copper	Solder
Liquid line	Wrought or cast copper	Solder

17. PIPE INSULATION

17.1 All insulating materials required for piping, mechanical equipment and ductwork etc. shall be furnished and installed under this Contract. The execution of the work shall be by the insulation manufacturer, in strict accordance with the best practice of the trade and the intent of this specification.

17.2 Pipes shall be insulated and covered as detailed below.

17.3 Piping which is exposed to weather, or called to be weather proof, shall be covered, in addition to insulation and finishes, with 45 Lbs. roofing felt, lapped three inches on all joints, using adhesive specified above, and soft aluminum bands 12 inches apart and then clad with 26-G galvanized steel sheet.

17.4 All vapour barriers shall be completely sealed against moisture penetration.

17.5 Indigenous asphalt impregnated craft paper, canvas and roofing felt of approved quality are to be used.

17.6 Chilled Water piping shall be insulated with sectional glass fiber FRK faced. All glass fiber shall have a density at least 4 lbs./ft³.
The thickness of the insulation shall be as under:

(i) Chilled Water pipes up to 1.5” Dia = 1” thick
(ii) Chilled Water pipes 2” to 2.5” Dia = 1.5” thick
(iii) Chilled Water pipes 3” & above Dia = 2” thick

17.7 Cooling Coil Condensate Pipe Insulation shall be 3/4" thick close cell foam insulation with PVC self-adhesive tape 2" wide.

18 AIR FILTERS

18.1 Furnish complete air filters for each air supply system of the specified capacities (annexure-B) and sizes in the schedule and on the drawings (annexure-A).

18.2 Each A/C unit shall be furnished complete with a single aluminum, permanent, washable 1" thick filter.

18.3 The air filters shall be permanent, clean able, high velocities, viscous oil type, using a media composed of corrugated strips of screen wire or sheet metal placed on edge of the airflow. The corrugations shall be tapered to form a series of pyramid shaped pockets to prevent dust from air. Expanded metal shall be placed on both sides of cleaning media to add strength and for mechanical protection. The filters shall be selected for face velocity not exceeding 450 Fpm. The initial resistance shall be less than 0.10" Wg.

18.4 The unit filters shall be mounted in air tight, preferably flat other wise angular, filter box of galvanized steel or aluminum sheet, so that they can be removed from either end for replacement or cleaning.

18.5 The air filter shall be of approved manufacture.

19 INSTRUMENTS & GAUGES

19.1 **Thermometers**

Thermometers shall be provided and installed in pipeline services in the locations indicated on the Contract Drawings (annexure-A).

Right angle or obtuse angle thermometers shall be provided for fitting to vertical faces.

Thermometers fitted more than 80-inches above the floor shall be of the dial type.

Dial thermometers for distance reading shall be provided with the necessary length of non-corrodible capillary tube encased in non-corrodible armoured sheath. All connecting tubes shall be neatly clipped to walls etc. with purpose-made clips spaced at not more than 300mm. Thermometers that are to be wall mounted shall be fixed to hardwood boards fixed securely to the wall.

19.2 **Pressure Gauges**

Pressure gauges shall be provided at the suction and discharges of all pumps.

Pressure gauges shall be provided to measure the static pressure drop across plant and equipment such as evaporators and condensers.

Pressure gauges on pumps and other equipment shall be 4-inches dial type having brass cases with a polished and lacquered finish. Bourdon tubes shall be of solid drawn phosphor bronze. Dials shall be white heat-resisting enamel with black figured scales. Gauges shall be accurate to ± 1% of scale range, between the 10% and 90% positions of the scale.

All gauges shall be fitted with a lever handled plug cock. A coil siphon shall also be installed for all pressure gauges.

Dial gauges, for distance reading shall be mounted on wall-fixed hardwood boards.

20 ELECTRICAL WIRING

20.1 The Contractor shall be responsible for complete electric wiring and earthing of the plant equipment and controls. The Employer shall only provide 3 phase and neutral, 4 wire supply point(s) at locations shown on the drawings (annexure-A) and detailed elsewhere in the documents.

20.2 The electric wiring shall be carried out in conduit, sheet metal channel, cable tray, or GI piping, all wiring buried in the floor and above false ceiling to be in PVC piping. The wire sizes shall be selected for satisfactory operation at least 110 deg. F of ambient temperature. The wiring and earthing shall be carried out according to the requirements of any local code and Pakistan PWD Schedule.

20.3 The terminal connections for motors, and where required, for starters, shall be made in flexible conduit. The terminal wiring for 230 volts, 1 phase fractional horse power motors, such as fan motors and their starter control switches, can be exposed PVC insulation and sheathed wiring, connections protected within the terminal box so that no line lead is exposed.

20.4 The wiring for electric/electronic automatic controls shall preferably be with single conductor wire which may be PVC insulated with conduit, exposed shielded or exposed PVC insulated and sheathed wiring in accordance with the recommendations of the control

manufacturer. The cover plates to avoid any hazard shall protect the live connections. The wiring outside the plant rooms or fan coil unit enclosures must be in conduit to avoid any mechanical damage.

20.5 All control boards shall be factory fabricated.

20.6 On each control board, incoming supply shall have air circuit breaker if the rating required is 1000 A or more, and moulded case circuit breaker in case of lower rating. Appropriate short circuit under voltage and thermal overload protection shall be provided. All breakers shall be of continuous type. The disconnect switch may be rotary type for 100 Amps, and lower rating. The fuses to be of the HRC time lag link type according to BS 88: 1952 and ASTA-20 certified. Two sets of replacement HRC fuses shall be supplied as spare for each disconnect switch. The Consultant may allow the use of high repute capacity, heavy continuous duty type, moulded case circuit breakers.

20.7 Single phasing prevented relay shall be provided for each 3-phase circuit of 1 HP and above rating. The Contractor shall supply and install necessary electric control boards, circuit breakers, disconnect switches, fuses, MCBs, earthing, etc. to complete the work. It would be required where possible, to mount all the circuit breakers, disconnect switches, fuses, starters, switches, relays, and controls in one machine room on the control board for ease of operation.

20.8 The control boards shall be of design and construction to provide easy access to all internal components for servicing and replacement. The large size boards to have multi-panel type construction. The board shall have hinged access doors at the front, swing not exceeding 10”, and of design that all work, servicing, maintenance, replacement, additions, and alternations can be carried out from the front without requiring access from back. The back panel shall be bolted and easily removable. The board to have protected busbars. The board to have indicating name plates for all items. Adequate front face illumination lights and internal lights shall be provided, if required. All circuits shall be numbered and tags fixed with the wires for identification. The main control board in the central plant room to have one 30 Amps, 3 phase service outlet with disconnect switch, fuses and 4 pole quick disconnect coupling, and two 15 Amps. and one amp 3 pin, single phase, service outlets with on-off switches and fuses. The control boards in the air handling unit rooms, plant rooms, etc. shall have one 15 Amp 3 pin single phase service outlet with on-off switch and fuse. Six sets of complete details of wiring diagrams fuse. Six sets of complete details of wiring diagrams for each board shall be supplied to the Employer and one set to be kept in a pocket in the respective board.

20.9 The Contractor shall be responsible for the complete power and control electric wiring of the air conditioning plants as required for the air conditioning system.

20.10 For remotely located equipment, a power point shall be supplied near each unit or where indicated on the drawings (annexure-A) and wiring onwards shall be the responsibility of the air conditioning contractor. This will also include all wiring from secondary panels to central control panel.

20.11 A licensed workman authorized to undertake such work under the provision of Pakistan Electricity Act and Rules shall carry out the electrification work.

20.12 The Contractor shall submit schematic electric wiring diagram, manufacturers construction drawings, technical literature for all components proposed to be used, to Consultants for checking and approval before the fabrication of boards is commenced. The work will be carried out only in accordance with the approved drawings and components.

21 AUTOMATIC TEMPERATURE CONTROL SYSTEM

21.1 TYPE

Temperature and automatic Control system shall be Direct Digital Control (DDC) with microprocessor based local control panel (BMS)

21.2 SCOPE

The Contractor shall furnish and install complete control system as Specified hereinafter. Control system shall include all components required for control system as described hereinafter and/or as shown on HVAC drawings (annexure-A). All necessary sensors, controllers, actuators, control valves, control power supplies, voltage stabilizers, line conditioners, thermostats, humidistats, flow switches damper motors, relays, safety devices, switches, linkages, control transformers, interconnecting wiring and conduit to form a complete system shall be supplied and fitted by the Contractor. The entire temperature and automatic control system shall bear nameplate of the manufacturer. It shall be commissioned by local representative of control system manufacturer.

Before starting the installation work, the control system schematic diagrams, made by the manufacturers or their qualified representative, shall be submitted to the Engineer for approval.

Calibrations and adjustments shall be made by a qualified representative of the manufacturer of controls to the approval of the Engineer. The control valves and thermometers shall be suitable for operating pressure and temperature. Valve shall have been tested at least 1-1/2 times rated working pressure. The insertion sensors in piping shall be provided with separable copper wells and all duct sensors shall be provided with duct mounting brackets, protection shields etc.

21.3 SIGNS

All thermostats, switches and control devices shall be clearly labeled with identifying nameplates.

21.4 FRAMED CONTROL DIAGRAMS

Approved Control Schematic diagrams showing the complete layout of each control system, including equipment and control function shall be furnished framed under glass or in approved laminated plastic for posting at approved locations.

21.5 CONTROL TRANSFORMERS

Dry-type transformers for controls of air conditioning system shall be generally indoor type. The transformer shall be rated to carry the maximum possible load continuously, and shall be designed for the particular system for which it is intended.

21.6 CONTROL POWER SUPPLY

Power to control power distribution panel shall be supplied from main HVAC distribution panel ACP-1. Power supply to all other control panels shall be from this control distribution panel.

21.7 THERMOSTATS

21.7.1 Thermostats where specified and/or shown on the Drawings (annexure-A) shall be cooling-heating type with changeover through DDC controls. Thermostats shall be low voltage and shall control (+/-1 Deg C) of temperature setting at the sensor location, unless otherwise specified. Thermostats shall be adjustable to temperature range and differential and shall be suitable for inside design temperature. Variations from above in the specifications of the standard thermostat forming integral part of the factory assembled equipment may be accepted with the approval of the Engineer. All room thermostat sensors

shall be mounted at wall 1.5 m above floor unless otherwise indicated at locations as directed by the Engineer.

Thermostats shall be modulating type for AHUs, unless otherwise specified or shown. Room thermostats other than installed in operating theatres shall have locking cover, with removable knob for setting, calibrated in degrees centigrade. Setting or re- setting shall not be possible without removing locking cover. Thermostats shall include temperature indicator.

21.7.2 Thermostats for fan coil units shall be integral with 3-speed fan switch, heating, cooling, wall mounted type, with on-off and heating-cooling switches. It should indicate room temperature and calibrations shall be in degrees Fahrenheit.

21.8 TEMPERATURE CONTROL METHOD

The manufacturer of control system shall submit through the Contractor suitable temperature control method and sequence of operation for Engineer's approval.

21.9 FLOW SWITCHES

Flow switches shall be pack less, vapour-type construction, with all vetted parts made of brass and designed for mounting in tees. Device shall be capable of being mounted in pipe tees 1 inch and larger. Paddle shall be provided with removable segments to accommodate required pipe size and flow. Switching shall be single pole, double throw time delay action type, with a rating of 5 amps. full load with 220 volts AC.

21.10 PRESSURE DIFFERENTIAL SWITCHES

Pressure switch to indicate positive flow of air shall be installed at each AHU fan and filter and/or as shown on control schematics.

21.11 DIRECT DIGITAL CONTROL (DDC) SYSTEM

21.11.1 General

The Microprocessor based control system (MBCS) shall comprise of various independent, stand- alone digital controllers (SDC's) along with Operator interface terminal units (OITC) to provide local access and control functions.

MICRO-PROCESSOR BASED CONTROL SYSTEM (MBCS) PERFORMANCE REQUIREMENTS.

Specifications described in this section are general guidelines to help the bidder understand the intent of the specifications. Deviations from these specifications will be allowed provided the intent of the specifications is fulfilled. However, each deviation from these specifications must be high-lighted at the time of the bid, and presented in full detail with complete write-up at the time of submittal.

Control wires of any kind will NOT be allowed across floors and between AHU rooms. Cross wiring between floors will only be allowed in the case where a single air handling unit has zones on different floors, or where an AHU has been installed above false ceiling, outside AHU Room or at floor other than area served
The SDC/SDM should be field programmable. The SDC's/SDM's with factory programmable capability only will not be allowed.

Any control/sensing devices in public areas, or in areas where un-authorized personnel have access to it shall have no or hidden set-points and/or over-riding relays. In case of no set-points/overriding relays, the SDC/SDM should be field programmable for the desired intent.

A comprehensive write-up detailing all components, sequence of operations and schematic drawings, for this project shall be presented at the time of submittal.

21.11.2 Minimum Hardware Performance Requirements

21.11.2.1 Stand-alone Digital Controllers Modules (SDC's/SDM's)

a) Description

Stand-alone Digital Controllers/Modules shall be 16-bit microcomputer based, providing a multi- tasking operating system for control functions.

SDC's/SDM's shall provide true floating point arithmetic calculations. To accommodate accumulation of large totalized values.

b) Application Program Protection

All programming defining the functions to be performed by the SDC/SDM, including but not limited to application programs and point database, shall be protected from loss due to

power failure for a minimum of 12 months. Systems providing non-volatile memory for these functions are preferred.

Systems not providing non-volatile memory shall provide Battery backup sufficient to provide protection for the specified period.

21.11.3 Automatic Temperature Control

The SDC's/SDM's shall interface to additional panels of equipment as required to provide the performance specified for Control Panels.

21.11.4 Control Panel

21.11.4.1 Each control panel shall be a fully electronic analog control or digital control system, providing all control functions for the equipment specified to be controlled from that panel. Control functions to be performed by control panels are as described in this specification in the point charts, and other relevant sections of these specifications.

It is the intent of this specification to provide the Employer with the ability to read out temperatures and other values, and to adjust specific items from localized control panel. In order to provide this Room capability, control panels are specified to be placed in specific locations.

Every control panel shall provide readouts for the temperatures, or other information, specified. Every control panel shall provide adjustments for the set points, parameters, and other adjustment functions specified.

At the least one control panel will be provided in each Air Handling Room. Control panels for ceiling-hung AHUs shall be installed in vicinity of AHU room.

21.11.4.2 Read Out of Items

Items specified for read out may be read through plug-in portable operator's terminals which are provided as part of MBCS. At least 2 operator terminals shall be provided. Read out of sensed variables used in control sequences shall be from the same sensors used for control. As an alternative, provide either a duplicate sensor for the read out, or provide a transducer for each sensed signal and a signal compatible with the controller.

Label shall be part of the digital display of the value.

21.11.4.3 **Adjustments**

Every control panel shall provide adjustments for the functions specified. In general, adjustments shall be provided for all set points used by controllers within each control panel. In addition, adjustments shall be provided for throttling ranges, mixed air damper minimum positions, or other items as specified/required Adjustments may be made through plug in portable operator's device.

21.11.5 **Sensing and Control Outputs Requirements**

21.11.5.1 **Sensing**

All sensing inputs shall be provided via industry standard signals. Temperature, humidity, differential pressure signals, and all other signal inputs shall be one of the following types:

0-20 mA
4-20 mA
0-5 VDC
0-12 VDC
Resistance Signals
On/Off Dry contact closure.

All signal inputs shall be compatible with the controllers used, and with the requirements for readout of variables as specified.

21.11.5.2 **Control Outputs**

(a) On/Off Outputs

Control panel shall internally provide test points for the circuit driving the equipment contactor, for the purpose of troubleshooting whether the 220 VAC circuit to the contactor is active. All such relays or digital output modules shall provide a pilot light or LED display of this same status.

(b) **Modulating Outputs**

Modulating outputs shall be industry standard 0-5 VDC, or 0-12 VDC. Milli amp outputs of 0-20 mA or 4-20 mA are also acceptable. Drive open/Drive closed type modulating outputs are acceptable provided that they also comply with the following requirements.

All modulating outputs shall provide within the control panel, a metric gauge, or display indication of the commanded position signal to the actuating device. This meter, gauge, or display must provide either a 0-100 percent position indication, or readout directly in the engineering units of the signal being used Drive open/ drive closed type controllers shall include sufficient components and control algorithms to comply with this requirement.

21.11.6 **Fire Stats**

The air handling unit discharge air sensor shall act as fire-stat. It will monitor the discharge air temperature, and upon its higher than user specified limits the respective AHU shall be bought to fail safe condition.

21.11.7 **Controlled Devices**

The valves for air handling units would be three-way/two-way as shown on control schematics, proportional type. The control valves for FCUs would be 2-way type. All valves shall be capable of handling the system design pressure and design temperature. The valve will incorporate a factory assembled actuator, capable of running at 220/50/1. All valves 2" and smaller size will have threaded connections, larger size valves will have standard flange connections.

The damper motors shall be designed with a safety factor of 1.5. The damper motors shall be suitable for mounting directly on the damper linkage.

All controlled devices will fail to close position. In case of 3-way valves, they will close to by-pass mode.

All valves shall close bubble tight against the operating head of the system. All valves shall be sized for maximum pressure drop of 40 Kpa unless specified otherwise hereinafter. All straight through water valves shall have equal percentage characteristics plugs. All valves which are used in sequence with another, and which are 65 mm and larger, shall be provided with positive positioner. Valve operators shall be of the heavy duty type, featuring a reversible motor, gear train and necessary relays.

21.11.8 **Standard Software Function Libraries**

All SDC's/SDM's shall have as a standard feature of their system software, complete libraries of control algorithms for DDC, Energy Management, and Facilities Management functions. These resident libraries of algorithms shall be drawn from for the creation of the application programming of each individual SDC/SDM.

21.11.9 **Application Software Documentation**

Contractor shall provide a blueprint documentation of the software application program for each SDC/SDM. Documentation provided shall include block software flow-chart showing the interconnection between each of the control algorithms and sequences. For systems utilizing program listings. A program listing shall be printed onto the same blueprint, along with the program flow-chart, and description of the sequence of operation. This blueprint shall be stored and maintained in each SDC/SDM panel. System acceptance shall not be completed until this documentation is provided and located in each panel.

21.11.10 **Energy Management Control**

The individual SDC's/SDM's shall perform Time of Day, Daily, Weekly, Calendar, Holiday Scheduling, Optimum start/stop, Enthalpy optimization, and all control optimization strategies, such as Supply Air Reset, and Soft Start Ramp up, for their connected systems of equipment.

21.11.12 **Distributed Access**

It is the intent of this specification to provide the Employer with MBCS information at distributed locations throughout the facility. Distributed access

SDC's/SDM's shall include at least 2 plugs-in operator devices with full alphanumeric display and a keypad for password controlled access to various levels of operational capability, from simple information access, to full programmability of SDC/SDM functions.

21.11.13 **Sequence of Operation**

Before preparing technical submittal for submission to the Engineer for approval, the control manufacturer's qualified representative should hold detailed discussions with the Engineer, along with a qualified representative of the Contractor.

After the general consensus on intended functions of Control system, the Control manufacturer's representative shall prepare a formal sequence of operation for submission to Engineer along with technical submittal, to the Engineer, through the Contractor. Sequence of Operation for both winter and summer modes shall be prepared describing power interlocks, adjustments, fire detection and smoke control, S.D.C. failure operation on emergency Set and operating sequences for:

- Air Handling Units.
- Packaged Air-Conditioners
- Control Rooms

21.11.14 **Indication**

Following equipment (whichever is applicable) shall have the indication at the local controller, located next to equipment;

EQUIPMENT	TYPE	INDICATION	LOCATION
• Smoke detector	DI	SMOKE/NO SMOKE	Local SDC
• Room Relative Humidity	AI	DIGITAL %RH	Local SDC
• Room/zone Air Temp.	AI	DIGITAL º F	Local SDC
• Supply Air Discharge Temp.		AI	DIGITAL º F Local SDC
• Air Filter P.D.S	DI	DIRTY/CLEAN	Local SDC
• Coil/valve	AO	0-100% OPEN	Local SDC
• Supply Air Fan	DO	ON/OFF	Local SDC
• Supply Air Fan P.D.S	DI	NO-PRESS/NRML	Local SDC
• Mixed Air temp.(OA-RA)	AI	DIGITAL º F	Local SDC
• Chilled/Hot water temp. (IN-OUT)		AI	DIGITAL º F Local SDC
• Re-Heat Coil	DO	ON/OFF	Local SDC
• Room Press. Transmitter	AI	Hi-PRESS/NRML	Local SDC
• Humidifier	DO	ON/OFF	Local SDC
• Fire Stats	DI	FIRE/NO FIRE	Local SDC
• Variable Frequency Drives		AO	0-100% ADJUSTMENT Local SDC
• Water Flow Switch	DI	FLOW/NO FLOW	Local SDC
• Water Pressure Transmitter		AI	DIGITAL Psi/Kpa Local SDC

21.11.15 **DDC POINT SUMMARY SHEET**

AI DI AO DO
==========

AI DI AO DO
==========

AHU'S 1& 2

Duct Smoke Detector	-	2	-	-
Return Air Temperature	2	-	-	-
Return Air Humidity	2	-	-	-
Main Supply Air Temperature	2	-	-	-
Fresh Air Temperature	2	-	-	-
Supply Water Temperature	2	-	-	-
Return Water Temperature	2	-	-	-
Supply Air Fan Status	-	2	-	-
Supply Fan Start/Stop	-	-	-	2
Fire Stat	-	2	-	-
3-way heating/cooling valve	-	-	2	-
Humidifier	-	-	-	2
Re Heat Coil	-	-	-	2
Filter D.P	-	2	-	-
Fresh Air Motorized Damper	-	-	-	2
Exhaust Air Fan Status	-	2	-	-
Exhaust Fan Start/Stop	-	-	-	2
Condenser Unit Status	-	2	-	-
Condenser Start/Stop	-	-	-	2
OT Room Pressure Transmitter	2	-	-	-

	AI	DI	AO	DO
	==========			

AHU-3 (1 No's AHU)

Duct Smoke Detector	-	1	-	-
Return Air Temperature	1	-	-	-
Return Air Humidity	1	-	-	-
Main Supply Air Temperature	1	-	-	-
Mixing Air Temperature	1	-	-	-
Supply Water Temperature	1	-	-	-
Return Water Temperature	1	-	-	-
Supply Air Fan Status	-	1	-	-
Supply Fan Start/Stop	-	-	-	1

Fire Stat		-	1	-	-
3-way heating/cooling valve	-	-	1	-	
Humidifier	-	-	-	1	
Re Heat Coil	-	-	-	1	
Filter D. P	-	1	-	-	
Fresh Air Motorized Damper	-	-	-	1	
Exhaust Air Fan Status	-	1	-	-	
Exhaust Fan Start/Stop	-	-	-	1	
Condenser Unit Status	-	1	-	-	
Condenser Start/Stop	-	-	-	1	
CSSD Pressure Transmitter	2	-	-	-	

BMS Software & Requirements

BMS lifetime licensed software with supporting licenses for all communication devices that shall be in communication bus.

Following shall be included and configured with BMS System;

-Workshop & Color Graphic Software
-Interface Connection
-BACnet type Protocol

Note:

1) Above given summary is just guideline. The exact summary shall be prepared by the Contractor.

22 PAINTING

22.1 The Contractor shall paint all hangers, bracing, MS Pipes, mounting frames and other related metal surfaces, and he shall also be responsible for all finish painting. The minimum numbers of coats are specified hereunder but sufficient coats shall be given to achieve desired finish.

22.2 Material for painting shall be high-grade products of well-known manufacturer, and when approved, shall be delivered on the site in original unbroken packages, bearing the maker's name and brand. Paints of approved color only shall be used for each application.

22.3 All surfaces shall be clean, dry and free from dust at the time any coating is applied.

22.3 Interior painting shall not be done when temperature is below 30 deg. F. Enamel shall not be applied when temperature is; below 70 deg. F. Exterior painting shall not be done in frosty, foggy or damp weather, or when the temperature is below 50 deg. F.

22.4 All plants, equipment's, pumps and motors; shall be provided with three coats of enamel paint in the factory and shall; be carefully cleaned and oiled after installation. In case the original paint has been damaged, fresh coats of enamel paint to match the original shall be given.

22.5 insulated, shall be thoroughly wire-brushed and have one coat of Red Oxide paint before insulation is applied. Boiler breaching and kitchen range hood ducts shall be painted with heat resistant paint.

22.6 All outside steel pipe work, duct bracing & angles or other steel equipment specified to be insulated, shall be thoroughly wire-brushed and have one coat of Red Oxide paint and one coat of Enamel paint before insulation is applied.

22.7 All pipes, ducts, hangers and duct angle bracing, which are located in concealed spaces, shall be given a one coat of Rex Oxide with one coat of Enamel paint before being concealed.

22.8 The interior of all duct and outlet boxer at the back of air grilles, registers and diffusers shall be painted with two coats of dull black paint.

22.9 All black steel ducting, piping and other equipment required to be insulated, shall be thoroughly wire-brushed and applied with one coat of Red Oxide paint before insulation is fixed, additionally one coat of Enamel paint in-case of outdoor installation.

22.10 The interior of masonry built up fresh air and fan chambers shall be applied two coats of odorless non-scaling paint.

22.11 All 8 oz. weight canvas jacketed insulated ducting and piping, in plant rooms or visible in the occupied areas, shall be given one coat of polyvinyl 1 acetate with water repellent emulsion and finished with two coats or synthetic enamel paint.

22.12 Paint shall be applied as per manufacturer's printed application directions. Paint

color scheme shall be specified at; the time of painting or earlier.

22.13 The ducting and piping shall be painted according to the color code based on American standard "Scheme for identification of piping systems." and used for finish painting. The Consultants shall approve all color codes and scheme.

22.14 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.

22.15 The Contractor shall further provide manufacturer's application directions, performance guarantee and literature's.

22 CLEANING AND TESTING

22.1 The Contractor shall, during construction, properly cap pipes and ducts to prevent the entrance of dirt, etc. Each ducting and piping circuit shall be blown through, after completion, for as long a time as necessary to thoroughly clean that circuit.

22.2 All air ducting sections shall be given a leak test before fixing insulation and cutting openings for branches and air devices. Any opening made shall be sealed off with airtight metal caps.

22.2.1 The ducts leak test shall be performed as following;

(a) Light Test Method — Low pressure ducts Upto 2.5" Wg.
(b) Smoke Test Method — Medium pressure ducts Upto 4" Wg.

22.2.2 All seams and joints shall be checked and all visual and noticeable leaks repaired in a good workman like manner, by filling with an approved sealant to the inside of the joint, so that the air pressure tends to force the sealant into the joint.

22.2.3 In case the Consultant directs the Contractor to carry out final measured leakage test for medium or high-pressure ducting, he will follow SMACNA procedure for leak testing.

22.3 All refrigerant piping shall be tested with nitrogen pressure of 1-1/2 times the operating pressure or at a pressure approved by the Engineer for a period of 23 hours to detect leaks and defects. There shall be no pressure loss over this period except that due to temperature fluctuation. All leaks and defects shall be made good in a proper workmanlike approved manner. If necessary piping shall be taken down and re-erected, and any make shift or temporary repair of leaks will not be permitted. Leak shall be determined by a soap

bubble method.

22.4 The Contractor shall be responsible for thoroughly flushing of M.S Pipe work with mains cold water to remove traces of loose dirt, scale and extraneous matter, prior to pre-commissioning cleaning.

22.4.1 When all sections of a system have been flushed, the Contractor shall notify the Engineer for the cleanliness of the system to be witnessed.

22.4.2 After completing the initial flushing procedures as described above, contractor shall arrange the Water Treatment specialist to carry out the pre-commissioning cleaning of the chilled water pipework system.

22.4.3 The purpose of this cleaning process is to remove light surface mill scale and small debris such as cement splashes from the internal pipework surfaces that may have entered the systems during the course of installation. It should be noted that this process will not safely dissolve pebbles, pieces of wood and metal by the use of any chemical and it is important that the contractor pays particular attention to the protection of all pipework throughout the installation period to prevent the ingress of foreign matter.

22.4.4 The pipework system shall be chemically cleaned using a pre-operational cleaner which shall remain in the systems for approximately 12-16 hours including a minimum period of 8 hours of pumped circulation.

22.4.5 The system shall then be drained and flushed until tests at all available sampling points show that all traces of suspended matter have been removed.

22.4.6 The systems shall be refilled with water only, and circulated for one hour and again drained down completely. When empty, the systems shall be refilled with fresh clean water.

22.4.7 Circulation shall be repeated. Constant flushing shall ensue until tests throughout the system indicate that the water quality is acceptable within the following concentrations from all flushing points: -

Total dissolved solids (TDS) - Equivalent to incoming fresh water

pH - Equivalent to incoming fresh water.

Iron in solution -	Below 3 ppm or equivalent to incoming fresh water, whichever is the greater.
Water Quality -	Visually clear, bright and free from suspended solids.

22.4.8 The above reading shall be witnessed by the Contractor and the Engineer for acceptance.

22.4.10 The system shall then be filled with clean water and dosed with an approved corrosion inhibitor. Contractor shall be responsible in-case of partially or completely drain down the systems for any reason, it is essential that the Engineer is informed and the Water Treatment Specialist is advised so that the chemical concentrations can be checked and if necessary, a further treatment introduced before the final commissioning of the systems.

22.4.11 Finally the water shall be analyzed to confirm that the correct condition and chemical concentration has been achieved.

Important Note: It is the responsibility of the Contractor to advise the Water Treatment Specialist of the materials used in the construction of the plant and systems, to ensure chemical compatibility.

22.5 The Contractor shall test all electric motors, electric wiring and earning earthling and furnish test records to the Engineer.

22.6 After the entire installation has been completed, the Contractor shall commission the equipment, making all necessary adjustments in the equipment, plants, balancing valves, air dampers, air devices, etc., as called for and submit reports of performance tests as specified elsewhere in this specifications.

23 COMMISSIONING AND PERFORMANCE TESTS

23.1 The air-conditioning system described in this specification and shown on the drawings (annaexure-A) shall be commissioned. A program for the commissioning, and any specified tests, shall be prepared and this shall be incorporated in the contract program following approval by the Engineer.

23.2 Commissioning shall mean the advancement of all the building services system, from the state of static completion to full working order, adjusted to the design requirements, which are given.

23.3 The cost of providing all instruments and associated equipment whether of a temporary and/or permanent nature, attendance of any specialists, and for the provision of test points required for; the commissioning; and testing, shall be included in the tender. A recent calibration certificate for each instrument shall be available for inspection.

23.4 Technical submittals of all HVAC Equipment to be got approved prior to purchase.

24 AIR / WATER BALANCING AND COMMISSIONING TESTS

24.1 The air/water balancing and commissioning tests of the HVAC system shall be carried out by an independent Testing, Adjusting & Balancing (TAB) agency.

24.2 The Contractor is bound to hire one good reputed TAB agency. The agency is responsible for submitting complete reports of the balancing and testing to the Project Engineer for approval. The Contractor is required to put the cost for balancing and testing in the BOQ accordingly.

25 DELIVERY, HANDLING AND STORAGE OF MATERIALS

25.1 All materials or manufactured items that are liable to damage shall be delivered in the original packages, containers, etc., bearing the name of the manufacturer and the brand.

25.2 Materials or manufactured items shall be carefully loaded, transported, unloaded and stored in an approved manner, protected from damage and exposure to weather or dampness during transit and after delivery to the Site.

26 RECORD DRAWINGS (AS BUILT DRAWINGS)

The Contractor shall submit to the Project Engineer, prior to Completion of the Works, a complete set of as-built drawings showing all changes from the original drawings (Annexure-A) during the progress of the work.

All record drawings and documents shall be fully up-dated to accord with the Works as built.

27 OPERATION & MAINTENANCE OF HVAC SYSTEM

The Contractor shall operate service and maintain complete HVAC system during the 1-year Period of Operation and Maintenance, 7days a week including other holidays if desired by the user. This service, shall include supply of operating staff, all necessary adjustments, greasing, oiling, cleaning and the furnishing of necessary tools, instruments, supplies and parts to keep the system in perfect operation, except such parts as made necessary by miss-use or neglect not caused by the Contractor. The Contractor has to submit all operation and maintenance data/record to the use by the end of contract. All costs incidental to the above specified Operating, Servicing and Maintenance shall be deemed to be included in the relevant pay item included in the Bill of Quantities.

The water, power, fuel oil and natural gas consumption charges during Maintenance Period shall be paid by the User.

The Contractor shall provide staff to operate and maintain the HVAC system for 24 hours a day.

28 OPERATING & MAINTENANCE MANUALS

Provide prior to Completion of the Works one copy of an operating & maintenance manuals, which shall be written in English.

These manuals shall fully describe start up and shutdown sequence, normal operating techniques and shall provide critical and non-critical alarms.

The manuals shall also give information on spares provided include diagrams and maintenance instruction.

BILL OF QUANTITY (BOQ)								
Supply & Installation of HVAC System for Operation Theaters (3 & 4) & CSSD								
				APPROVED MANUFACTURER BRAND				
ITEM NO.	DESCRIPTION/CODE	UNIT	QTY.	1	2	3	UNIT COST (RS)	TOTAL AMOUNT (RS)
1	DISMENTLING OF EXISTING DUCTING WORKS FROM OPERATION THEATERS (OT-3 & 4) AT FIRST FLOOR & CSSD 2nd Floor, COMPLETE IN ALL RESPECT	LOT	1	N/A	N/A	N/A		
2	SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF DUEL COIL (CHILLED WATER & DX COIL) HYGIENI CERTIFIED AIR HANDLING UNITS INCLUDING UNLOADING, LIFTING AND PLACING AT FOUNDATIONS AS SHOWN ON DRAWINGS (annexure-A) , SCHEDULED AND SPECIFICATIONS (Annexure-B), COMPLETE IN ALL RESPECT			Traine (Europe/ Turkey)	York (Europe/ Turkey)	Untes (Europe/Turkey) or Equivalent Approved by the HVAC Engineer PIC-MTI		
	AHU-1 For OT-3 (100 % Fresh Air)	NO	1					
	AHU-2 For OT-4 (100 % Fresh Air)	NO	1					
	AHU-3 For CSSD (20 % Fresh Air)	NO	1					

3	SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF HIGH AMBIENT AIR COOLED MATCHING CONDENSER FOR DX COIL OF RELATED AHU WITH MICROPROCESSOR CONTROLLER & ALL RELEVANT CONTROLS, INCLUDING UNLOADING, LIFTING AND PLACING AT FOUNDATIONS AS SHOWN ON DRAWINGS (Annexure-A), SCHEDULED AND SPECIFICATIONS (Annexure-B), COMPLETE IN ALL RESPECT			Traine (Malaysia/ Thailand / Turkey)	York (Malaysia/ Thailand / Turkey)	Carrier(Malaysia/Thailand/Turkey) or Equivalent Approved by the HVAC Engineer PIC-MTI		
	CU-1 For OT-3	NO	1					
	CU-2 For OT-4	NO	1					
	CU-3 For CSSD	NO	1					
4	SUPPLY, INSTALLATION, TESTING & COMISSIONING OF DUCT MOUNTED TYPE ELECTRIC OPERATED SELF GENERATING STEAM HUMIDIFIER INCLUDING UNLOADING LIFTING FIXING AS SHOWN ON DRAWINGS (Annexure-A) AND SPECIFIED, SCHEDULED (Annexure-B) IN TENDER SPECIFICATION, COMPLETE IN ALL RESPECT.			Vepac (Imported)	Devatec (Imported)	Carel (Imported) or Equivalent Approved by the HVAC Engineer PIC-MTI		
	HUM-1	NO	1					
	HUM-2	NO	1					

	HUM-3	NO	1					
5	SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF DUCT MOUNT ELECTRICAL RE-HEAT COIL INCLUDING UNLOADING, LIFTING AND FIXING AS SHOWN ON DRAWING (Annexure-A) AND SPECIFIED, SCHEDULED (Annexure-B) IN TENDER SPECIFICATION, COMPLETE IN ALL RESPECT.			Local Made as Per Approval of HVAC Engineer PIC-MTI				
	RHC-1	NO	1					
	RHC-2	NO	1					
	RHC-3	NO	1					
6	SUPPLY & INSTALLATION OF EXHAUST FANS AS SPECIFIED, SCHEDULED.& SHOWN ON DRAWINGS (Annexure-A)			Local Made as Per Approval of HVAC Engineer PIC-MTI				
	EF-1	NO	1					
	EF-2	NO	1					
	EF-3	NO	1					
7	SUPPLY AND INSTALLATION OF DUCTING & SHEET METAL WORK COMPLETE WITH HANGERS, BRACINGS, SPLITTER DAMPERS ETC, COMPLETE IN ALL RESPECT.			Pak Steel Mills	ISL (Pak)	ASL (Pak) or Equivalent Approved by the HVAC Engineer PIC-MTI		
	US GAUGE 26	SFT	500					
	US GAUGE 27	SFT	10500					
	US GAUGE 28	SFT	100					

	US GAUGE 29	SFT	100					
8	SUPPLY & INSTALLATION OF G.I SHEET CLADDING WITH US GAUGE 26 FOR OUTDOOR INSULATED DUCTS S, COMPLETE IN ALL RESPECT.			Pak Steel Mills	ISL (Pak)	ASL (Pak) or Equivalent Approved by the HVAC Engineer PIC-MTI		
	GI Cladding	SFT	10000					
9	SUPPLY & INSTALLATION OF FIBER GLASS BALNKET INSULATION HAVING FACTORY APPLIED FRK FACING PROTECTED WITH 8OZ CANVAS CLOTH COMPLETE WITH ADHESIVES, SEALERS AND PROTECTIONS, COMPLETE IN ALL RESPECT.			Afico (Saudi/Kuwait/China)	Kimco (Saudi/Kuwait/China)	Owen Corning (Saudi/Kuwait/China) or Equivalent Approved by the HVAC Engineer PIC-MTI		
	1.0" THICK INSULATION FOR INDOOR INSTALLATION OF DENSITY 1.0 LBS/Ft3	SFT	7000					
	2.0" THICK INSULATION FOR OUTDOOR INSTALLATION OF DENSITY 1.5 LBS/Ft3	SFT	7000					
10	SUPPLY & INSTALATION OF AIR DEVICES AS SPECIFIED, SCHEDULED (Annexure-B) AND SHOWN ON DRAWINGS (Annexure-A), COMPLETE IN ALL RESPECT.			Steel Craft	Air Carrier	Shan Industries or Equivalent Approved by the HVAC Engineer PIC-MTI		
	SAD (SUPPLY AIR DIFFUSER)	SFT	200					
11	SUPPLY & INSTALLATION OF 18 GAUGE GI SHEET VOLUME CONTROL DAMPERS AS SPECIFIED , COMPLETE IN ALL RESPECT			Steel Craft	Air Carrier	Shan Industries or Equivalent Approved by the HVAC Engineer PIC-MTI		

	VCD (VOLUME CONTROL DAMPER)	SFT	100					
12	SUPPLY AND INSTALLATION OF 2" THICK WASH ABLE ALUMINUM MESH FILTERS OTHER THAN INSTALLED IN AHUS FABRICATED WITH MIN. 12 MESH LAYERS			As Per Approval of HVAC Engineer PIC-MTI				
	Filters	SFT	30					
13	SUPPLY AND INSTALLATION OF GLASS FIBER SOUND LINER OF DENSITY 1.5 LBS/Ft3 COMPLETE WITH ADHESIVES & SEALERS, COMPLETE IN ALL RESPECT.			As Per Approval of HVAC Engineer PIC-MTI				
	SL	SFT	400					
14	FLEXIBLE DUCT CONNECTORS 6" WIDE FACTORY FABRICATED WITH COATD WOVEN FABRIC AND GI COLLARS BOTH BY MEANS OF DOUBLE LOCK SEAM ON EACH SIDE			As Per Approval of HVAC Engineer PIC-MTI				
	FDC	RFT	180					
15	SUPPLY & INSTALLATION OF COPPER REFRIGERANT PIPES INCLUDING CONTROL WIRE WITH 3/4" THICK CLOSE CELL FOAM INSULATION PROTECTED WITH PVC TAPE, FOR FOR MATCHING CONDENSER & AHU, INCLUDING HANGERS, COMPLETE IN ALL RESPECT			Muller USA	Lovata	Crane or Equivalent Approved by the HVAC Engineer PIC-MTI		

	DISTANCE BETWEEN AHU-1 & CU-1 (1-1/8", 1/2")	RFT	100					
	DISTANCE BETWEEN AHU-2 & CU-2 (1-1/8", 1/2")	RFT	100					
	DISTANCE BETWEEN AHU-3 & CU-3 (1-1/8", 1/2")	RFT	100					
16	SUPPLY & INSTALLATION OF TRUNKING OF G.I SHEET (US GAUGE-22) WITH REMOVEABLE TOP COVER FOR EXPOSED COPPER PIPES AS SHOWN ON THE DRAWINGS (Annexure-A)			Local Made as Per Approval of HVAC Engineer PIC-MTI				
	GI Trunk	RFT	200					
17	SUPPLY AND INSTALLATION OF ELECTRICAL WORKS AS SPECIFIED AND SHOWN ON DRAWINGS (Annexure-A)							
	(a) SUPPLY & INSTALLATION OF WEATHERPROOF ELECTRICAL PANELS			Siemens	Electromech	South Asian or Equivalent Approved by the HVAC Engineer PIC-MTI		
	ACP-1	NO	1					
	(b) SUPPLY & INSTALLATION OF CONDUITING AND WIRING ONWARD FROM ACP-1 PANELS TO ALL HVAC EQUIPMENT.	LOT	1	Pakistan cables	Fast Cables	Newage or Equivalent Approved by the HVAC Engineer PIC-MTI		

	(c) SUPPLY & INSTALLATION OF MAIN POWER CABLING WITH GROUNDING CABLING FROM MAIN DB (AT HVAC PLANT ROOM) TO ACP-1 INCLUDING CABLE TRAY, COMPLETE IN ALL RESPECT							
	1 CORE 240 Sq.mm CU/PVC/PVC - 600/1000 VOLTS	RFT	2800	Pakistan cables	Fast Cables	Newage or Equivalent Approved by the HVAC Engineer PIC-MTI		
	1 CORE 70 Sq.mm CU/PVC - 450/750 VOLTS (AS CPC)	RFT	800	Pakistan cables	Fast Cables	Newage or Equivalent Approved by the HVAC Engineer PIC-MTI		
	12"X4" CABLE TRAY (HOT DIP GALVANIZED) WITH COVER	RFT	500	Pakistan cables	Fast Cables	Newage or Equivalent Approved by the HVAC Engineer PIC-MTI		
18	SUPPLY ,INSTALLATION & COMMISSIONING OF AUTO CONTROLS FOR EACH AHU COMPLETE WITH DDC STANDALONE CONTROLLERS ENABLE TO COMMUNICATE ON BACNET IP BASED NETWORK WITH OPERATOR INTERFACE TERMINAL UNIT (OITU) TEMPERATURE SENSORS, HUMIDITY SENSORS, SMOKE DETECTORS, CONTROL TRANSFORMERS, CONTROL VALVES, PRESSURE DIFFERENTIAL SWITCHES, AREA PRESSURE SWITCHES, CURRENT SENSORS,			Reliable	Honywell	Johnson Controls or Equivalent Approved by the HVAC Engineer PIC-MTI		

	DAMPER ACTUTATORS, VALVE ACTUATORS, OT ROOM MOUNTED TEMPERATURE & HUMIDTY CONTROLLERS WITH DISPLAY OF TEMPERATURE,HUMIDITY AND SPACE PRESSURE ETC,CONTROL TRANFOMERS, CONTROL PANELS, CONTROL WIRING AND CONDUITING WITH LOGIC DESIGNING COMPLETE IN ALL RESPECTS AS PER SPECIFICATIONS AND AS SHOWN ON CONTROL SCHEMATIC DRAWINGS (Annexure-A) AS PER THE SATISFACTION OF ENGINEER INCHARGE.							
	AHU-1 / CU-1	NO	1					
	AHU-2 / CU-2	NO	1					
	AHU-3 / CU-3	NO	1					
19	Installation of Hepa Filters for OT 3 & 4	NO	10	Impoorted & approved by the Engineer				

20	INTEGRATION OF ABOVE MENTIONED AHU'S CONTROLS WITH EXISTING BMS INCLUDING WIRING , TESTING & COMMISSIONING, NETWORK INTERFACE CARDS, GRAPHICS DESIGNING & GUI DEVELPOMENT COMPLETE IN ALL RESPECTS AS PER THE SATISFACTION OF ENGINEER INCHARGE. TEMEPERATURE, HUMIDITY & PRESSURE CONTROL & MONITORING DEVICES MUST BE INSTALLED IN ALL OT'S & CSSD	JOB	1	N/A	N/A	N/A		
21	SUPPLY AND INSTALLATION OF BALANCING VALVE			TACO	VRI	ECONOSTOor Equivalent Approved by the HVAC Engineer PIC-MTI		
	DIA 2.50 INCH	NO	3					
	DIA 4.00 INCH	NO	1					
22	SUPPLY AND INSTALLATION OF STRAINERS.			ECONOS TO	CRANE	TOZEN or Equivalent Approved by the HVAC Engineer PIC-MTI		
	DIA 2.50 INCH	NO	3					
23	SUPPLY & INSTALLATION OF PRESSURE GAUGES COMPLETE WITH SIPHAN & GUAGE COCKS.	NO	6	Imported as Per Approval of HVAC Engineer PIC-MTI				
24	SUPPLY AND INSTALLATION OF PIPE LINE THER-MOMETERS COMPLETE WITH THERMOWELLS.	NO	6	Imported as Per Approval of HVAC Engineer PIC-MTI				
25	SUPPLY AND INSTALLATION OF DRAIN COCKS.			Imported as Per Approval of HVAC Engineer PIC-MTI				

	DIA 0.75 INCH	NO	3					
	SUPPLY AND INSTALLATION OF AUTOMATIC AIR VENTS	NO	3					
27	SUPPLY & INSTALLTION OF PVC PIPING AND FITTINGS INCLUDING HANGERS, ANCHOR BOLTS FOR HUMIDIFIER MAKEUP WATER.			Local Made as Per Approval of HVAC Engineer PIC-MTI				
	DIA 0.75 INCH	RFT	10					
	DIA 1.00 INCH	RFT	150					
28	SUPPLY AND INSTALLATION OF HIGH DENSITY (64 KG/M3) FIBER GLASS PIPE INSULATION FACED WITH ALUMINIUM FOIL FOR CHILLED WATER PIPING, FITTINGS INCLUDING VALVES STRAINERS ETC AND PROTECTED WITH 8OZ CANVAS CLOTH WITH ADHESIVES, COMPLETE IN ALL RESPECT			Afico (Saudi/Kuwait/China)	Kimco (Saudi/Kuwait/China)	Owen Corning (Saudi/Kuwait/China) or Equivalent Approved by the HVAC Engineer PIC-MTI		
	DIA 1.00 INCH (1.00" THICK)	RFT	50					
	DIA 2.50 INCH (1.50" THICK)	RFT	312					
	DIA 3.00 INCH (2.00" THICK)	RFT	50					
	DIA 4.00 INCH (2.00" THICK)	RFT	456					
29	SUPPLY AND INSTALLATION OF GATE VALVES.			ECONOSTO	CRANE	TOZEN or Equivalent Approved by the HVAC Engineer PIC-MTI		
	DIA 1.00 INCH	NO	3					
	DIA 2.50 INCH	NO	6					
	DIA 4.00 INCH	NO	2					

30	SUPPLY & INSTALLTION OF PVC PIPING AND FITTINGS WITH 3/4" THICK CLOSE CELL FOAM INSULATION PROTECTED WITH PVC TAPE INCLUDING HANGERS, ANCHOR BOLTS FOR CONDENSATE DRAIN WATER.			BETA	DADEX	as Per Approval of HVAC Engineer PIC-MTI		
	DIA 0.75 INCH	RFT	45					
	DIA 1.25 INCH	RFT	120					
31	SUPPLY & INSTALLATION OF M.S SEAMLESS SCHEDULED 40 PIPING & FITTINGS EXCLUDING VALVES AND STRAINERS INCLUDING HANGERS ANCHOR BOLTS, RUBER VIBRATION ISOLATORS FOR CHILLED WATER CIRCULATION.			TECO	LONTRIN	HUFFAZ or Equivalent Approved by the HVAC Engineer PIC-MTI		
	DIA 1.00 INCH	RFT	50					
	DIA 2.50 INCH	RFT	312					
	DIA 3.00 INCH	RFT	50					
	DIA 4.00 INCH	RFT	456					
32	PAINTING & EQUIPMENT IDENTIFICATION	LOT	1	Local Made as Per Approval of HVAC Engineer PIC-MTI				
33	INSPECTION, TESTING COMMISSIONING AND AIR Balancing	LOT	1	N/A	N/A	N/A		
34	SHOP AND AS-BUILT DRAWINGS	LOT	1	N/A	N/A	N/A		
35	OPERATION AND MAINTENANCE OF ONE YEAR AFTER ISSUENCE OF PARTIAL COMPLETION	JOB	1	N/A	N/A	N/A		

	CERTIFICATE							
36	RELATED CIVIL WORKS INCLUDING EQUIPMENT FOUNDATIONS AND COORDINATION WITH OTHERS.	LOT	1	Local Made as Per Approval of HVAC Engineer PIC-MTI				
37	Installation of Exhaust System for Existing Operation theaters (1,2,5, & 6) & Air Balancing of all 6 No's of OT's as per designed CFM	NO	4	Local Made as Per Approval of HVAC Engineer PIC-MTI				
38	Installation of Laminar flow grills for all OT's	NO	6	Imported as Per Approval of HVAC Engineer PIC-MTI				
	TOTAL (PKR):							

1. Bid Form and Price Schedules

Date:_____
IFB No:_____

To:

Hospital Director,
Peshawar Institute of
Cardiology,Medical
Teaching Institution,
Peshawar.

Sir,

Having examined the bidding documents including Addenda Nos. [insert numbers], the receipt of which is hereby duly acknowledged, we, the undersigned, offer to supply and deliver [description of goods and services] in conformity with the said bidding documents for the sum of [total bid amount in words and figures] or such other sums as may be ascertained in accordance with the Schedule of Prices attached herewith and made part of this Bid.

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

If our Bid is accepted, we will obtain the guarantee of a bank in a sum equivalent to _____percent of the Contract Price for the due performance of the Contract, in the form prescribed by the Procuring agency.

We agree to abide by this Bid for a period of [number] days from the date fixed for Bid opening under Clause 22 of the Instructions to Bidders, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

Until a formal Contract is prepared and executed, this Bid, together with your written acceptance thereof and your notification of award, shall constitute a binding Contract between us.

Commissions or gratuities, if any, paid or to be paid by us to agents relating to this Bid, and to contract execution if we are awarded the contract, are listed below:

Name and address of agent	Amount and Currency	Purpose of Commission or gratuity

(if none, state “none”)

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

Price Schedule in Pak. Rupees

Name of Bidder_____IFB Number_____Page of_____

1	2	3	4	5	6	7
Item	Description	Country of Origin	Quantity	Unit price DDP named place	Total DDP per item	Unit price of Delivered duty paid (DDP) to final destination plus price of other incidental services if required3

Signature of Bidder _____

Note: In case of discrepancy between unit price and total, the unit price shall prevail.

2. Bid Security Form

Whereas [name of the Bidder] (hereinafter called "the Bidder") has submitted its bid dated [date of submission of bid] for the supply of [name and/or description of the goods] (hereinafter called "the Bid").

KNOW ALL PEOPLE by these presents that WE [name of bank] of [name of country], having our registered office at [address of bank] (hereinafter called "the Bank"), are bound unto [name of Procuring agency] (hereinafter called "the Procuring agency") in the sum of for which payment well and truly to be made to the said Procuring agency, the Bank binds itself, its successors, and assigns by these presents. Sealed with the Common Seal of the said Bank this_____day of_20_.

THE CONDITIONS of this obligation are:

1. If the Bidder withdraws its Bid during the period of bid validity specified by the Bidder on the BidForm; or

2. If the Bidder, having been notified of the acceptance of its Bid by the Procuring agency during theperiod of bid validity:

   a. fails or refuses to execute the Contract Form, if required; or
   b. fails or refuses to furnish the performance security, in accordance with the Instructionsto Bidders;

We undertake to pay to the Procuring agency up to the above amount upon receipt of its first written demand, without the Procuring agency having to substantiate its demand, provided that in its demandthe Procuring agency will note that the amount claimed by it is due to it, owing to the occurrence of one or both of the two conditions, specifying the occurred condition or conditions.

This guarantee will remain in force up to and including twenty eight (28) days after the period of bid validity, and any demand in respect thereof should reach the Bank not later than the above date.

_____

[signature of the bank]

CONTRACT FOR ENGINEERING CONSULTANCY SERVICES

Between

HOSPITAL DIRECTOR PESHAWAR INSTITUTE OF CARDIOLOGY PIC-MTI,
5-A, SECTOR B-3, HAYATABAD PHASE-V, PESHAWAR

And

M/S _____

For

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF HVAC SYSTEM (Condenser Units & AHU's) FOR OPERATION THEATERS (3 & 4) & CSSD AT PIC-MTI PESHAWAR

Sep 2022

Draft

CONTRACT AGREEMENT

This CONTRACT (hereinafter called the "Contract") is made on the _____ day of sep, 2022 and made effective with effect from _____between, on the one hand **HOSPITAL DIRECTOR PESHAWAR INSTITUTE OF CARDIOLOGY PIC-MTI PESHAWAR** (hereinafter called the "employer" which expression shall include the successors, legal representatives and permitted assigns)

And

on the other hand, **M/**s (xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx) (hereinafter called the "Contractor" which expression shall include the successors, legal representatives and permitted assigns).

WHEREAS

(a) the Employer has requested the for **SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF HVAC SYSTEM (Condenser Units & AHU's) FOR OPERATION THEATERS (3 & 4) & CSSD AT PIC-MTI PESHAWAR**.as defined in the General Conditions of Contract attached to this Contract (hereinafter called the "Goods"); and

(b) the Contractor, having represented to the Client that they have the required professional skills, personnel and technical resources, have agreed to provide the Goods on the terms and conditions set forth in this Contract;

NOW THEREFORE the Parties hereby agree as follows:

1. The following documents shall be deemed to form an integral part of this Contract:

(a) the General Conditions of Contract;
(b) the Special Conditions of Contract;
(c) After Pre-Bid Request for Proposal (RFP)
(d) Financial Proposal
(e) Terms and Condition:

2. The mutual rights and obligations of the Employer and the Contractor shall be as set forth in the Contract, in particular:

(a) The Contractor shall carry out the goods in accordance

with the provisions of the Contract; and

(b) The Employer shall make payments to the supplier in accordance with the provisions of the Contract.

IN WITNESS WHEREOF, the Parties hereto have caused this Contract to be signed in their respective names in two identical counterparts, each of which shall be deemed as the original, as of the day, month and year first above written.

Hospital Director Peshawar Institute Of Cardiology, PIC-MTI (CLIENT)	M/sxxxxxxxxxxxxxx xxxxxxxxxxxxxxx (Supplier)
Witness-1	Witness-1
Signatures_____	Signatures _____
Name _____	Name _____
Title _____	Title _____
	(Seal)
Witness-2	Witness-2
Signatures_____	Signatures _____
Name _____	Name: _____
Title _____	Title: _____
	(Seal)

Terms And Conditions

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 Employer and the Contractor, 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 Equipment**" means all the equipment, machinery, and/or other materials which the Contractor is required to supply to the Employer under the Contract.

(c) "**The Employer**" means **PIC-MTI, Peshawar** his administrators and legal representatives, assigns and successors.

(d) "**Engineer**" means the HVAC Engineer PIC-MTI of the Employer appointed from the time by the Employer and notified in writing to the Contractor to act as "Project Engineer" for the purposes of the Contract.

(e) "**The Contractor**" means the Tenderer whose tender has been accepted by the Employer and shall include Contractor's legal personal representatives, successors and permitted assigns.

(f) "**As Scheduled**" means as detailed in Equipment Schedule.

(g) "**Equipment Schedule**" means equipment data as provided for in the Technical Specifications for the purpose of equipment selection.

(h) "**HVAC**" means Heating, Ventilation and Air Conditioning.

(i) "**Works**" means all the works to be executed in accordance with the Contract

(j) "**Final Acceptance**" means final acceptance by Employer after satisfactory commissioning and performance tests.

(k) "**Manufacturer**" means the Manufacturer of the Equipment furnished by the Contractor.

(l) "**Commissioning**" means putting into full operational service and compliance with the specifications as set forth in these documents.

1. Responsibilities of the Contractor

1.1. Technical Specification/Scope of Work

1.1.1. The Contractor shall furnish all labor, materials, equipment, tools, appurtenances, services, temporary work and storage including unloading and storage at site necessary to completely, supply, install, test, commission, and maintain the Heating, Ventilation and Air-conditioning system all in the perfect operating condition in accordance with the Specifications. The Contractor shall also adjust, balance, readjust all the air and refrigerant systems as specified. The Contractor shall commission, operate and maintain all the system for a period specified elsewhere in the Specifications under maintenance period, as specified.

1.1.2. The equipment and material selected and used for the works by the Contractor shall be inspected by the Engineer Incharge and, if not approved shall be removed forthwith from the site by the Contractor and replaced by equipment and materials conforming with the requirements of the Contract.

1.1.3. The works shall be in accordance with the technical specifications and Bill of Quantity (BOQ) attached to the Contract.

1.1.4. The delivery of equipment and materials to the site is to be arranged by the Contractor in consultation with the Engineer Incharge.

1.1.5. Without limiting the generality of the foregoing the work consists of:

i. Supply, installation, testing, commissioning and maintenance of HVAC system. The system shall comprise of installation of Air Handling Units (AHU), Matching Condensing Units and other accessories to complete the system in all respects. The Contractor shall be responsible for air and water balancing of entire HVAC system.
ii. Construction of foundations for AHUs and Condensing Units.
iii. (Providing and installation of all necessary controls, electric wiring, distribution and control boards and panels as specified.
iv. Supplying and installing any other item or equipment required to complete the system in all respects.

1.1.6. Specifications are only general guidelines and by no means cover details of such equipment. These only spell out the intent of the requirement. The details have to be provided by the Contractor along with details of performance, construction and technical literature.

1.2. Programme to Be Furnished

1.2.1. The Contractor shall, within 15 days of after singing of contract agreement, submit in writing, for the approval of the Engineer:

(a) Full particulars of the organization and staff through which he proposes to execute the Contract.
(b) Critical path, PERT scheduling of the program of works, or a bar chart showing the order of procedure and method in which he proposed to carry out the works with all activities.
© Design and Drawing (annexure-A).

1.2.2. If the program submit by the Contractor is not to the satisfaction of the Engineer Incharge, either as a whole or part thereof, the Contractor shall amend this program in accordance with Engineer Incharge instructions.

1.2.3. The acceptance or approval of such program by the Engineer Incharge shall in no way relieve the Contractor of any of his duties or responsibilities under the Contract.

1.3. **Time for Completion**

1.3.1. The overall project shall be completed within twelve (12) months, unless such time shall be extended as hereinafter provided.

1.3.2. Should the Contractor be delayed in the execution or completion of the works by the act, neglect, delay or default of the Employer, or if such delay be occasioned by Force Majeure as defined in section 26 of terms and conditions hereof, or by alterations or additions by the Engineer Incharge in the original plans and specifications during the progress of the works, then any such delay shall not be deemed to be a fault of the Contractor and the time for completion shall be extended in relation to time lost by reason of the aforesaid causes.

1.3.3. The term “Force Majeure” as employed herein shall mean, but not by limitation, any riots, political disturbances, mobilization, wars, fires, floods, storms, accidents, and other acts of God.

2. **Changes, Alteration and Additions**

2.1. The Engineer Incharge may, at any time, give further instructions and directions as may be necessary for the guidance of the Contractor. The Engineer Incharge may order work or material either in addition to that provided for in specifications, or dispense with or change the dimensions, character, quality, description, location or positioning of whole or any part of the works or materials provided for in specifications. The Contractor shall perform his work in accordance with such conditions, omissions or alterations as if these had been included in or omitted from the original plans and specifications.

2.2. Such variation order(s) shall not, in any way, vitiate or invalidate the Contract.

2.3. All additional work or omissions resulting from variation orders as aforesaid, shall be valued at the rates and price set out in the schedules of item wise prices and item rates, or if the said schedule does not contain applicable rates and prices, then suitable rates and prices based upon the Contract, or in default of agreement, fixed by the Engineer incharge, as the case may be, shall be either added to or deducted from the sum which would otherwise have been payable to the Contractor.

2.4. The Engineer incharge shall determine whether compliance with such variation orders increase or decrease the cost of works to the Contractor.

3. **Default of The Contractor**

If the Contractor shall fail to complete the works within the time prescribed in section 1.3.1 hereof or extended time, then the Employer may, without prejudice to any other method or recovery, deduct the amount of liquidated damages per day stated in the section 22 (penalty) below from any money due, or which may become due, to the Contractor. Such deduction shall not relieve the Contractor from his obligations to complete the work.

5. Country of Origin

5.1. All Equipment supplied under the Contract shall have their origin in the countries and territories eligible under Contract.

5.2. For purposes of this Clause “origin” means the place where the Equipment were manufactured.

6. **Standards**

6.1. The Equipment supplied under this Contract shall conform to the standard mentioned in the Technical Specifications, and, when no applicable standard is

mentioned, to the authoritative standard appropriate to the Equipment' country of origin and such standards shall be the latest issued by the concerned institutions.

7. Use of Contract Documents and Information

7.1. The Contractor shall not, without the Employer's prior written consent, disclose the Contract, or any provision thereof, or any specification, plan, drawings, pattern, sample or information furnished by or on behalf of the Employer in connection therewith, to any person other than a person employed by the Contractor in the performance of the Contract. Disclosure to any such employed person shall be made in confidence and shall extend only so far as may be necessary for the purposes of such performance.

7.2. The Contractor shall not, without the Employer's prior written consent, make use of any document or information enumerated in Para. 7.1 except for purposes of performing the Contract.

7.3. Any document, other than the Contract itself, enumerated in Para, 7.1 shall remain the property of the Employer and shall be returned (in all copies) to the Employer on completion of the Contractor's performance under the Contract if so required by the Employer.

8. Patent Rights

Not Used

9. **Performance Security**

9.1. Within the time stated in the special Condition clause 7.1, the Contractor shall furnish performance Security to the Employer in the amount and in the form specified in the Special Condition.

9.2. The proceeds of the performance Security shall be payable to the Employer as compensation for any loss resulting from the Contractor's failure to complete its obligations under the Contract.

9.3. The Performance Security shall be denominated in Pak Rupees and shall be in the form stated in the Special Condition.

9.4. The Performance Security will be discharged by the Employer and returned to the Contractor not later than 30 days following the date of completion of the job i.e. successful testing & commissioning of entire HVAC system.

10. **Pre-Shipment Inspection of Equipment = N/A**

11. **Packing**

11.1. The Contractor shall provide such packing of the Equipment 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 Equipment' final destination and the absence of heavy handling facilities at all points in transit.

11.2. 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, or in any subsequent instructions ordered by the Employer.

12. **Delivery of Equipment**

12.1. Delivery of the Equipment shall be made by the Contractor in accordance with the clause mentioned above.

13. **Insurance**

13.1. The Equipment supplied under the Contract shall be fully insured in Pak Rupees against loss or damage incidental to manufacture or acquisition, transportation, storage, delivery upto installation in the manner specified in the Special Condition of Contract by the Contractor at his cost.

14. **Transportation**

14.1. Transport of the Equipment to the point of destination as specified in the Contract shall be arranged and paid for by the Contractor. No reimbursement shall be made by the Employer on this account.

15. **Warranty**

15.1. The Contractor warrants that the Equipment supplied under the Contract are new, unused, of the most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the Contract. The Contractor further warrant that the Equipment supplied under this Contract shall have no defect arising from design, materials or workmanship or from any act or omission of the Contractor and. Or manufacturer, that may develop under normal

use of the supplied Equipment in the conditions obtaining in Pakistan.

15.2. This warranty shall remain valid for a period stated in the Special Conditions of Contract clause 15.1.

15.3. The Employer shall promptly notify the Contractor in writing of any claim arising under this warranty.

15.4. Upon receipt of such notice, the Contractor shall, with all reasonable speed, repairs or replace the defective Equipment as specified in SC clause 15.4

15.5. If the Contractor, having been notified, fails to remedy the defect(s) within a reasonable period, the Employer may proceed to take such remedial action as may be necessary, at the Contractor's risk and expense and without prejudice to any other rights which the Employer may have against the Contractor under the Contract.

16. Prices

16.1. Prices charged by the Contractor for Equipment delivered and Services performed under the Contract shall not vary from the prices quoted by the Contractor in his Tender until completion of entire works.

17. **Contract Amendments**

17.1. No variation in or modification of the terms of the Contract shall be make except by written amendment signed by the parties.

18. **Assignment**

18.1. The Contractor shall not assign, in whole or in part, its obligations to perform under the Contract, except with the Employer's prior written consent.

19. Sub Contracts

Not allowed

20. **Delays in the Contractor's Performance**

20.1. Delivery of the Equipment and performance of services shall be made by the Contractor in accordance with the time schedule specified in sub section1.3.1.

20.2. An unexcused delay by the Contractor in the performance of its delivery obligations

shall render the Contractor liable to any or all the following sections: forfeiture of its performance security, imposition of liquidated damages, and/or termination of the Contract for default.

21. **Liquidated Damages**

21.1. if the Contractor fails to deliver any or all of the Equipment or perform the services within the time period (s) specified in the term and condition section 1.3.1, the Employer shall without prejudice to its other remedies under the Contract, deduct from the Contract price, as liquidated damages up to a maximum deduction as specified in the terms and condition section 22 below.

22. Penalty

22.1. The Penalty on liquidated damage and non-compilation on time period specified in terms and condition section 1.3.1. or extendable period shall be charged asunder At the rate of 0.05% of the accepted Contract Value subject to max. of 10% of the said value for every day of delay the works remain uncommented or unfinished beyond the respective dates of commencement and completion and compensation for cancellation of the contract and differential amount due to award of contract to the other contractors.

23. **Termination of Contract**

23.1. The Employer may, without prejudice to any other remedy for breach of Contract, by a written notice of default sent to the Contractor, terminate the Contract in whole or in part:

a) If the Contractor fails to deliver any or all of the Equipment within the time period(s) specified in the Contract, or any extension thereof granted by the Employer
b) If the Contractor fails to perform any other obligation(s) under the Contract.

23.2. In the event the Employer terminates the Contract in whole or in part, the Employer may procure, upon such terms and a such manner as it deems appropriate, Equipment similar to those undelivered, and the Contractor shall be liable to the Employer for any access costs for such similar Equipment. However, the Contractor shall continue performance of the Contract to the extent not terminated.

24. **Termination of Insolvency**

24.1. The Employer may add any time terminate the Contract by given writing notice to the Contractor, without compensation to the Contractor, if the Contractor becomes bankrupt or other insolvent, provided that such termination will not prejudiced or affect any right to action or remedy which has accrued or will accrue thereafter to the Employer.

25. **Termination for Convenience**

25.1. The Employer, may by written notice send to the Contractor, terminate the Contract, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is for the Employer's convenience, the extent to which performance of work under the Contract is terminated, and the date upon which such termination becomes effective.

25.2. The Equipment those are complete and ready for shipment within 30 days after the Contractors receipt of notice of termination shall be purchased by the Employer at the Contract terms and prices. For the remaining Equipment, the Employer may elect:

To have any portion completed and delivered at the Contract term and prices.

26. **Force Majeure**

26.1. Notwithstanding the provisions of the Conditions of Contract Clause-22, 23 & 24 the Contractor shall not be liable forfeiture for its performance security, liquidated damages or termination for default, if and to the extent that, its deeply in performance or other failure to perform its obligation under the Contract is the result of an event of force majeure.

26.2. For purposes of this clause "Force Majeure" means an event beyond the control of Contractor and not involving the Contractor's fault or negligence and not foreseeable. Such event may include, but are not restricted to, acts of the Employers either in its sovereign or Contractual capacity, wars or revolutions, fire, floods, epidemics, quarantine restrictions and freight embargoes.

26.3. If a force majeure situation arises, the Contractor shall promptly notify the Employer in writing of such conditions and the cause hereof. Unless otherwise directed by the Employer in writing, the Contractor shall continue to perform its obligations under the Contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by force majeure event.

27. **Resolution of Dispute**

27.1. The Employer and the Contractor shall make every effort to resolve amicably by direct informal negotiation any disagreement or dispute arising between them under or in connection with the Contract.

27.2. If, after thirty (30) days from the commencement of such informal negotiations, the

Employer and the Contractor have been unable to resolve amicably a Contract dispute, either party may require that the dispute be referred for resolution to the formal mechanism specified in the special conditions of the Contract. This mechanism may include, but are not restricted to, conciliation mediated by a third party, adjudication in a Pakistan court and/ or arbitration. The mechanism shall be specified in the special conditions of Contract.

28. **Governing Language**

28.1. The Contract shall be written in the language of the Tender, as specified by the Employer in the instructions to tenderers. Subject to Conditions of Contract Clause-30, that language version of the Contract shall govern its interpretation. All correspondence and other documents pertaining to the Contract which are exchanged by the parities shall be written in that same language.

29. **Application Law**

29.1. The Contract shall be interpreted in accordance with the laws of Pakistan.

30. **Notice**

30.1. Any notice given by one party to the other pursuant to the Contract shall be sent in writing or by letter by facsimile message and confirmed in writing to the address specified for that purpose in the special conditions of Contract.

30.2. A notice shall be effective when delivered or on the notice's effective date, whichever is later.

31. **Tax and Duties**

31.1. The Contractor shall be entirely responsible for all taxes, stamp duties, license fees, and other such levies imposed outside Pakistan.

31.2. the Contractor shall be entirely responsible for all taxes, duties, license fees, etc. incurred inside Pakistan until delivery of the Contracted Equipment to the Employer.

32. **Payments**

- 50 %payment will be made upon the delivery of main unit /total material
- 40% after successful completion of project.
- 10% after defect liabilities.

All the above payment will be condition to verification of bill by PIC-MTI (Engineer /director

building and facilities).

33. **Signing of the Service Agreement**

33.1. The Successful Bidder shall receive an invitation in form of Letter of Award from Peshawar Institute of Cardiology PIC-MTI with the aim to sign a Contract Agreement for Required Goods as defined in the Technical Specification and Bill of Quantity (BOQ). The Successful Bidder shall, within Fourteen days (14) days of receipt of Letter of Award, furnish Performance Security in favour of Hospital Director Peshawar Institute of Cardiology. The successful bidder shall immediately sign the agreement with Peshawar Institute of Cardiology PIC-MTI.

4. Performance Security Form

To: [name of Procuring agency]

WHEREAS [name of Supplier] (hereinafter called "the Supplier") has undertaken, in pursuance of Contract No. [reference number of the contract] dated 20 to supply [description of goods and services] (hereinafter called "the Contract").

AND WHEREAS it has been stipulated by you in the said Contract that the Supplier shall furnish you with a bank guarantee by a reputable bank for the sum specified therein as security for compliance with the Supplier's performance obligations in accordance with the Contract.

AND WHEREAS we have agreed to give the Supplier a guarantee:

THEREFORE WE hereby affirm that we are Guarantors and responsible to you, on behalf of the Supplier, 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 Supplier to be in default under the Contract and without cavil or argument, any sum or sums within the limits of [amount of guarantee] as aforesaid, without your needing to prove or to show grounds or reasons for your demand or the sum specified therein.

This guarantee is valid until the day of 20 .

Signature and seal of the Guarantors

[name of bank or financial institution]

[Address]

[date]

5. INTEGRITY PACT

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

Contract No. Dated of Contract] Contract Value: [To be filled in at the time of signing Contract Title:

[name of Supplier] hereby declares that it has not obtained or induced the procurement of any contract, right, interest, privilege or other obligation or benefit from Government of Khyber Pakhtunkhwa (GoKP) or any administrative subdivision or agency thereof or any other entity owned or controlled by GoKP through any corrupt business practice.

Without limiting the generality of the foregoing, [name of Supplier] represents and warrants that it has fully declared the brokerage, commission, fees etc. paid or payable to anyone and not given or agreed to give and shall not give or agree to give to anyone within or outside Pakistan either directly or indirectly through any natural or juridical person, including its affiliate, agent, associate, broker, consultant, director, promoter, shareholder, sponsor or subsidiary, any commission, gratification, bribe, finder's fee or kickback, whether described as consultation fee or otherwise, with the object of obtaining or inducing the procurement of a contract, right, interest, privilege or other obligation or benefit in whatsoever form from GoKP, except that which has been expressly declared pursuant hereto.

[name of Supplier] certifies that it has made and will make full disclosure of all agreements and arrangements with all persons in respect of or related to the transaction with GoKP and has not taken any action or will not take any action to circumvent the above declaration, representation or warranty.
[name of Supplier] accepts full responsibility and strict liability for making any false declaration, not making full disclosure, misrepresenting facts or taking any action likely to defeat the purpose of this declaration, representation and warranty. It agrees that any contract, right, interest, privilege or other obligation or benefit obtained or procured as aforesaid shall, without prejudice to any other rights and remedies available to GoKP under any law, contract or other instrument, be voidable at the option of GoKP..

Notwithstanding any rights and remedies exercised by GoKP in this regard, [name of Supplier] agrees to indemnify GoKP for any loss or damage incurred by it on account of its corrupt business practices and further pay compensation to GoKP in an amount

equivalent to ten time the sum of any commission, gratification, bribe, finder's fee or

kickback given by [name of Supplier] as aforesaid for the purpose of obtaining or inducing the procurement of any contract, right, interest, privilege or other obligation or benefit in whatsoever form from GoKP.

Name of Buyer: …… Name of Seller/Supplier: ……
Signature: ……[Seal] Signature .....{Seal]

Purchase officer (QZ)
PIC-MT Peshawar

Asst Manager Purchase
PIC-MTI Peshawar

Manager Material Management
PIC-MTI Peshawar

HVAC Engineer
PIC-MTI Peshawar

Manager Building & Facilities
PIC-MTI Peshawar

Bio-Medical Engineer
PIC-MTI Peshawar

Director Building & Facilities
PIC-MTI Peshawar

Director Finance
PIC-MTI Peshawar

Hospital Director
PIC-MTI Peshawar

Annexure-A

INDEX

DRG NO	DESCRIPTION	QTY
HVAC-01	HVAC INDEX LEGEND AND GENERAL NOTES	1NO.
HVAC-02	HVAC LAYOUT OF FIRST FLOOR PLAN	1NO.
HVAC-03	HVAC LAYOUT OF SECOND FLOOR PLAN	1NO.
HVAC-04	HVAC LAYOUT OF ROOF & MUMTY PLAN	1NO.
HVAC-05	HVAC BMS & TEMPERATURE CONTROL DIAGRAM FOR OT AHU's 1 & 2	1NO.
HVAC-06	HVAC BMS & TEMPERATURE CONTROL DIAGRAM FOR CSSD AHU 3	1NO.
HVAC-07	HVAC STANDARD DETAIL'S	1NO.
HVAC-08	HAVC ELECTRICAL DISTRIBUTION DRAWING	1NO.

GENERAL NOTES:

1-ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.

2-ALL DRAIN PIPING SHALL BE TERMINATED AT NEAREST FLOOR DRAIN.

3-THESE DRAWINGS ARE ONLY FOR TENDER PURPOSE THE FINAL DRAWINGS WILL BE SUBMIT AT THE TIME OF CONSTRUCTION.

4-WHEN EXACT CAPACITY OF HVAC EQUIPMENT IS NOT AVAILABLE AS SPECIFIED IN SCHEDULES NEXT LARGER UNIT SHALL BE PROVIDED.

5-THE CONTRACTOR SHALL FURNISH SHOP DRAWINGS IN DOUBLE LINE FOR APPROVAL BEFORE EXECUTION OF HVAC WORKS.

6-CONTRACTOR SHALL FURNISH SECTIONS WHEREVER DUCTS CROSSING EACH OTHER OR WHEREVER SPECIAL APPLICATION IS APPLIED.

7-CONTRACTOR SHALL COORDINATE AT SITE WITH ALL OTHER SERVICES BEFORE EXECUTION OF HVAC WORKS.

8-SIZE OF FOUNDATION FOR AHU's, CHILLER & CONDENSERS WILL BE DETERMINED AFTER DETAILED TECHNICAL SUBMITTALS FROM SUPPLIER.

9-THE MOTOR RATING AS MANTIONED ON ELECTRICAL DRAWING ARE INDICATIVE ONLY.ACTUAL PANEL RATING SHALL BE ADJUSTED AS PER EQUIPMENT BEING SUPPLIED

10-U-TRAP FOR OIL IN RETURN COPPER PIPE SHALL BE PROVIDED FOR EACH CIRCUIT.

11-ALL REFRIGERANT PIPES INSIDE THE BUILDING BE CONCEALED AND OUTER PIPES BE ROUTED THROUGH GI/DURA DUCT.

12-HVAC CONTRACTOR TO COORDINATE WITH OTHER TRADE ENSURE SPACE & OTHER ISSUES.

13-HVAC CONTRACTOR TO COMPLY WITH ASHRAE, SMACNA, ASTM, NFPA STANDARDS.

14-CONTRACTOR TO ENSURE LOCATION OF ALL DEVICES AS INSTRUCTED BY SITE ENGINEER.

15-INSTALLATION FIRM TO ENSURE PROPER SEALING OF FALSE CEILING PANELS TO PROVIDE PLENUM FOR RETURN AIR.

16-HVAC CONTRACTOR TO ENSURE PROVISION OF SUITABLE MEASURES (SOUND LINER ETC) AT DISCHARGE OF AHU's TO CONTROL SOUND LEVEL WITHIN DESIRABLE LIMITS.

17-ALL THE DUCT WORKS TO BE CARRIED OUT AS PER "SMACNA" STANDARDS. (TYPICAL)

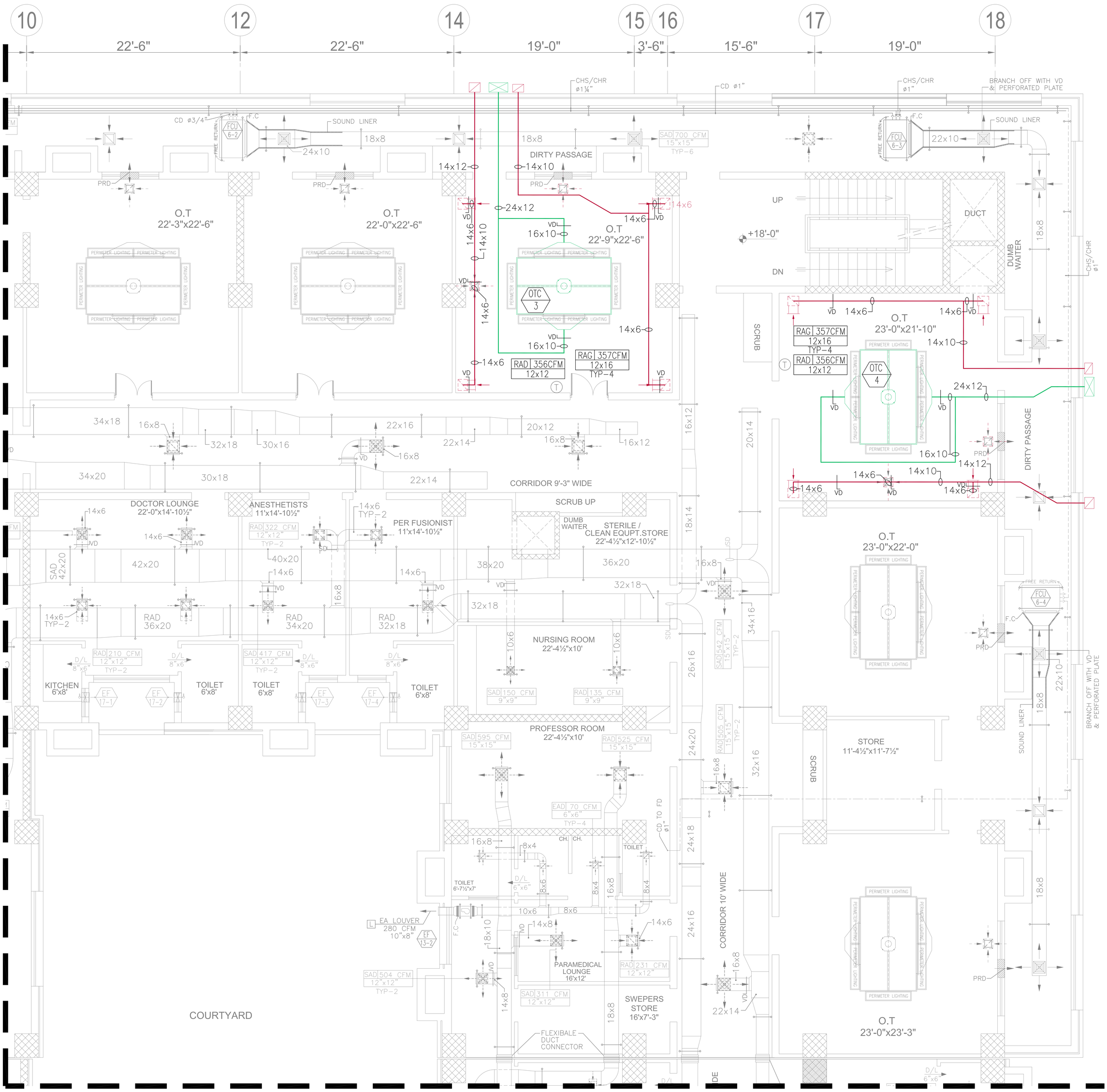
18-AIR DEVICES/VCD's TO BE PROVIDED ON EACH BRANCH DUCT FOR AIR BALANCING. (TYPICAL)

19-CLADDING OF ALL OUTDOOR INSULATED DUCTS & CHILLED WATER PIPES TO BE CARRIED OUT WITH 26 GAUGE G.I SHEET.

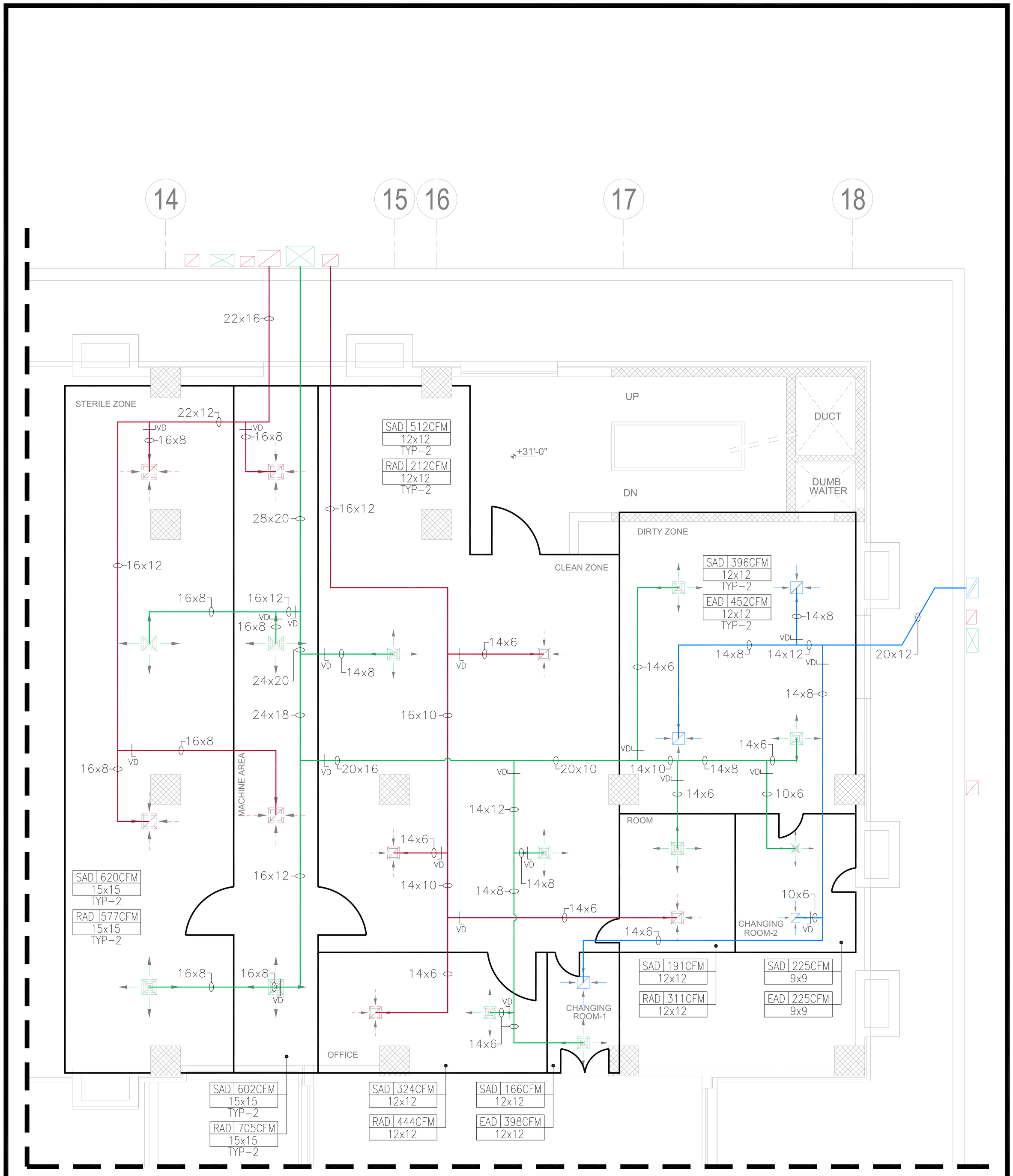
LEGEND

AHU	AIR HANDLING UNIT
CU	CONDENSER UNIT
CH	CHILLER
HUM	HUMIDIFIER
RHC	ELECTRIC RE-HEAT COIL
CD TO FD	CONDENSATE DRAIN TO FLOOR DRAIN
SA DUCT	SUPPLY AIR DUCT
RA DUCT	RETURN AIR DUCT
VD	VOLUME CONTROL DAMPER
MD	MOTORIZED DAMPER
SAD	SUPPLY AIR DIFFUSER
RAD	RETURN AIR DIFFUSER
EAD	EXHAUST AIR DIFFUSER
RAG	RETURN AIR GRILL
OTC	OPERATION THEATER CEILING
FC	FLEXIBLE DUCT CONNECTOR
CHS	CHILLED WATER SUPPLY
CHR	CHILLED WATER RETURN
AS	AIR SEPARATOR
L	LOUVER
F	FILTER
EF	EXHAUST FAN
ACP	APPARATUS CONTROL PANEL
A	AMPERE METER
V	VOLT METER
R Y B	INDICATION LIGHTS
	REMOTE PUSH BUTTON
	PUSH BUTTON
	SINGLE POLE BREAKER
	THREE POLE CIRCUIT BREAKER
ASS	AMPERE SELECTOR SWITCH
VSS	VOLT SELECTOR SWITCH
T	TEMPERATURE SENSOR
H	HUMIDITY SENSOR
S	SMOKE DETECTOR
F	FIRE STAT
T & H	TEMPERATURE & HUMIDITY SENSOR
S/S	FAN MOTOR / UNIT STARTER
CHC	CHILLED WATER COIL
HUM	SPRAY HUMIDIFIER
RHC	RE-HEAT COIL
DPS	DIFFERENCIAL PRESSURE SWITCH
	BUZZER
TS	TEMPERATURE SET POINT
	FILTER
PTD	PRESSURE TRANSMITTER DISPLAY TYPE
	PRESSURE GAUGE
	THERMOMETER
	GATE VALVE
	BALANCING VALVE
	DRAIN COCK
	STRAINER

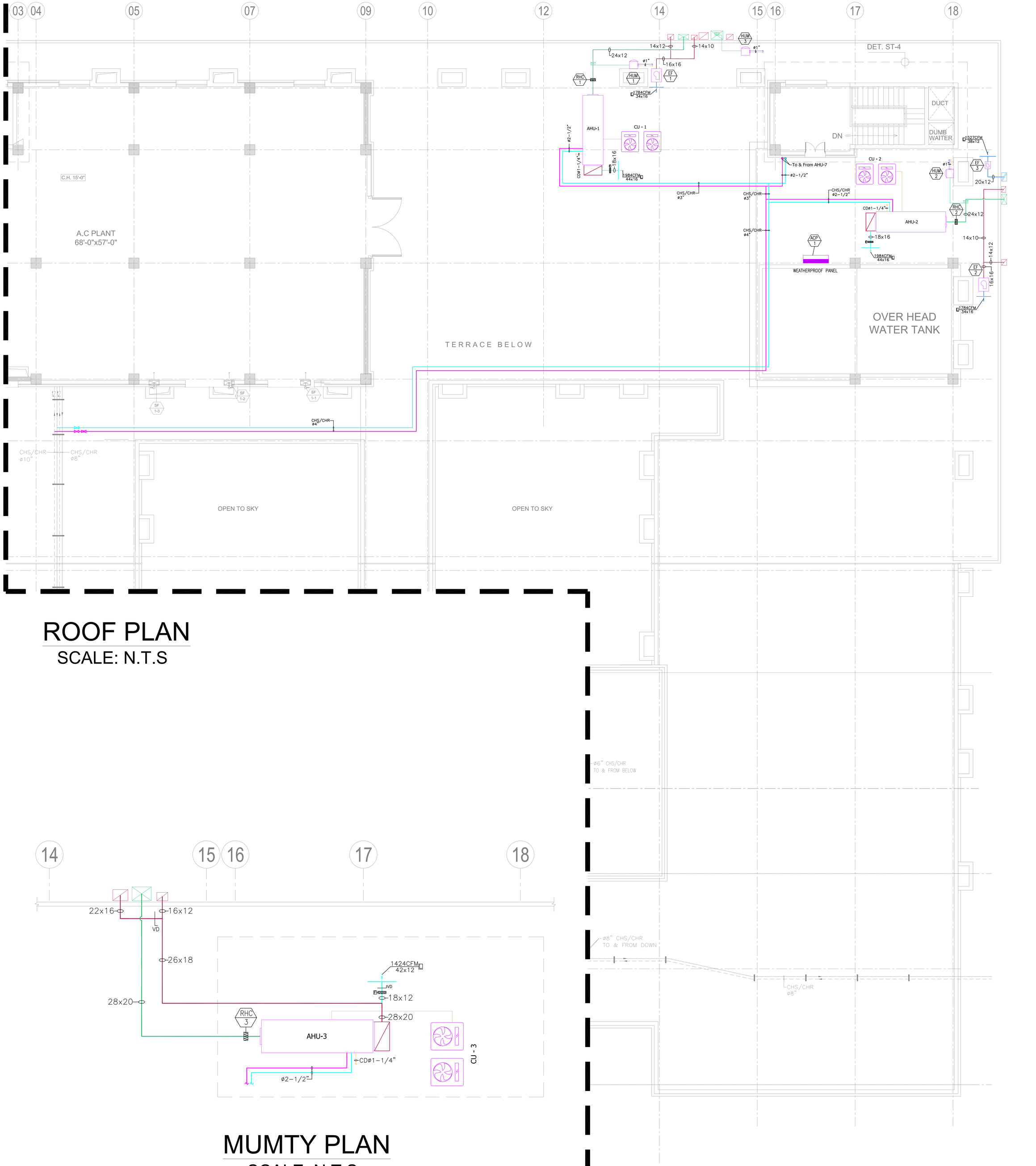
PROJECT: MTI (MEDICAL TEACHING INSTITUTE) PESHAWAR INSTITUTE OF **CARDIOLOGY** **HAYATABAD,PESHAWAR**	PREPARED BY : I.A	DATE:	28-9-2022
	DRAWN BY: M.A.T	JOB # :	---
JOB TITLE: HVAC INDEX LEGEND AND GENERAL NOTES	CHECKED BY: I.A	SCALE :	N.T.S
	APPROVED BY : I.A	DRAWING # :	HVAC-01



PROJECT: MTI (MEDICAL TEACHING INSTITUTE) PESHAWAR INSTITUTE OF **CARDIOLOGY** **HAYATABAD,PESHAWAR**	PREPARED BY : I.A	DATE:	28-9-2022
	DRAWN BY: M.A.T	JOB # :	---
JOB TITLE: HVAC LAYOUT OF FIRST FLOOR PLAN	CHECKED BY: I.A	SCALE :	N.T.S
	APPROVED BY : I.A	DRAWING # :	HVAC-02



PROJECT: MTI (MEDICAL TEACHING INSTITUTE) PESHAWAR INSTITUTE OF **CARDIOLOGY** **HAYATABAD,PESHAWAR**	PREPARED BY : I.A	DATE:	28-9-2022
	DRAWN BY: M.A.T	JOB # :	---
JOB TITLE: HVAC LAYOUT OF SECOND FLOOR PLAN	CHECKED BY: I.A	SCALE :	N.T.S
	APPROVED BY : I.A	DRAWING # :	HVAC-03



ROOF PLAN

SCALE: N.T.S

MUMTY PLAN

SCALE: N.T.S

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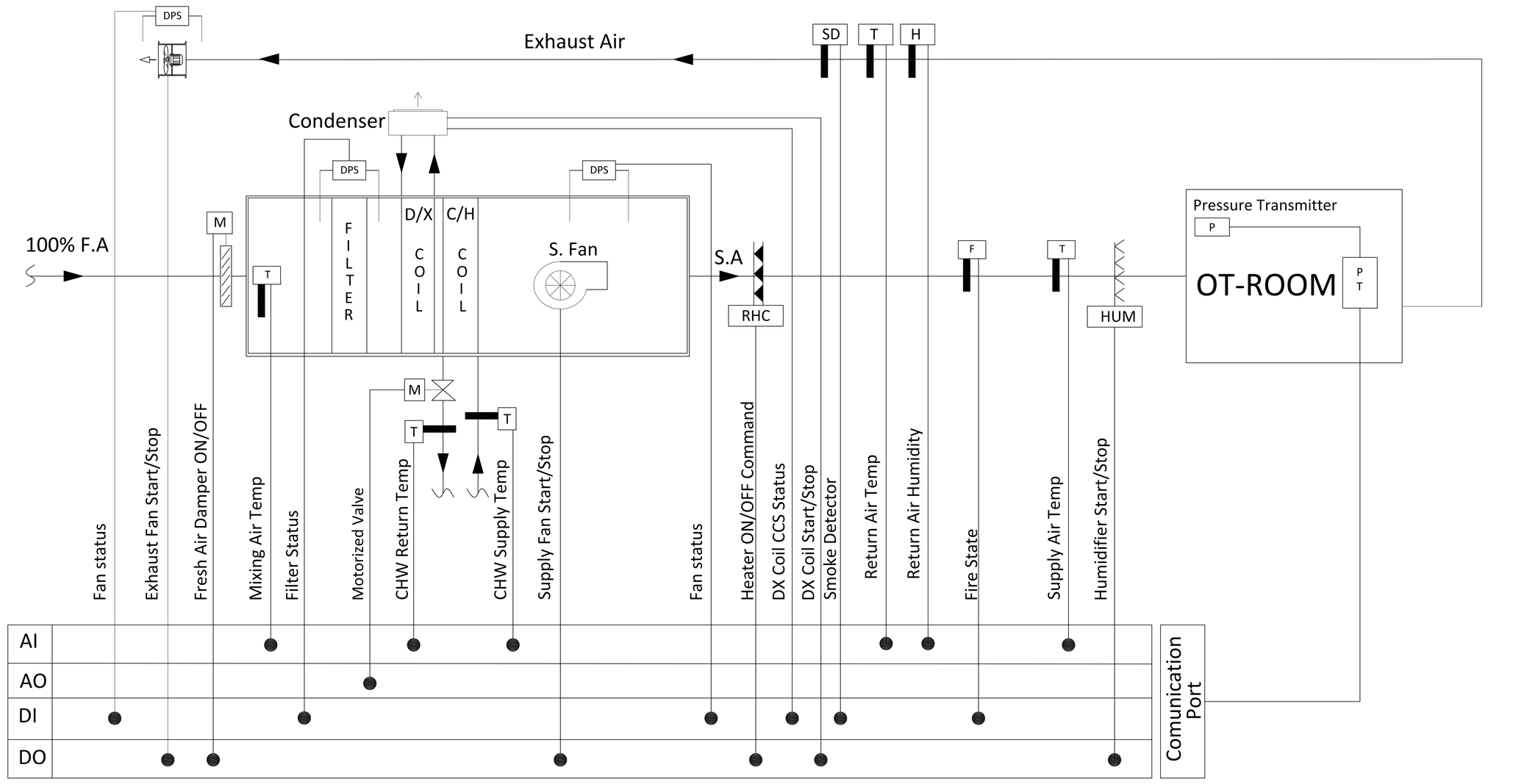
	DRAWN BY: M.A.T	JOB # :	---
JOB TITLE: HVAC LAYOUT OF ROOF & MUMTY PLAN	CHECKED BY: I.A	SCALE :	N.T.S
	APPROVED BY : I.A	DRAWING # :	HVAC-04



Schematic Diagram Typical for OT Air Handling units 1 & 2

SEQUENCE OF OPERATION

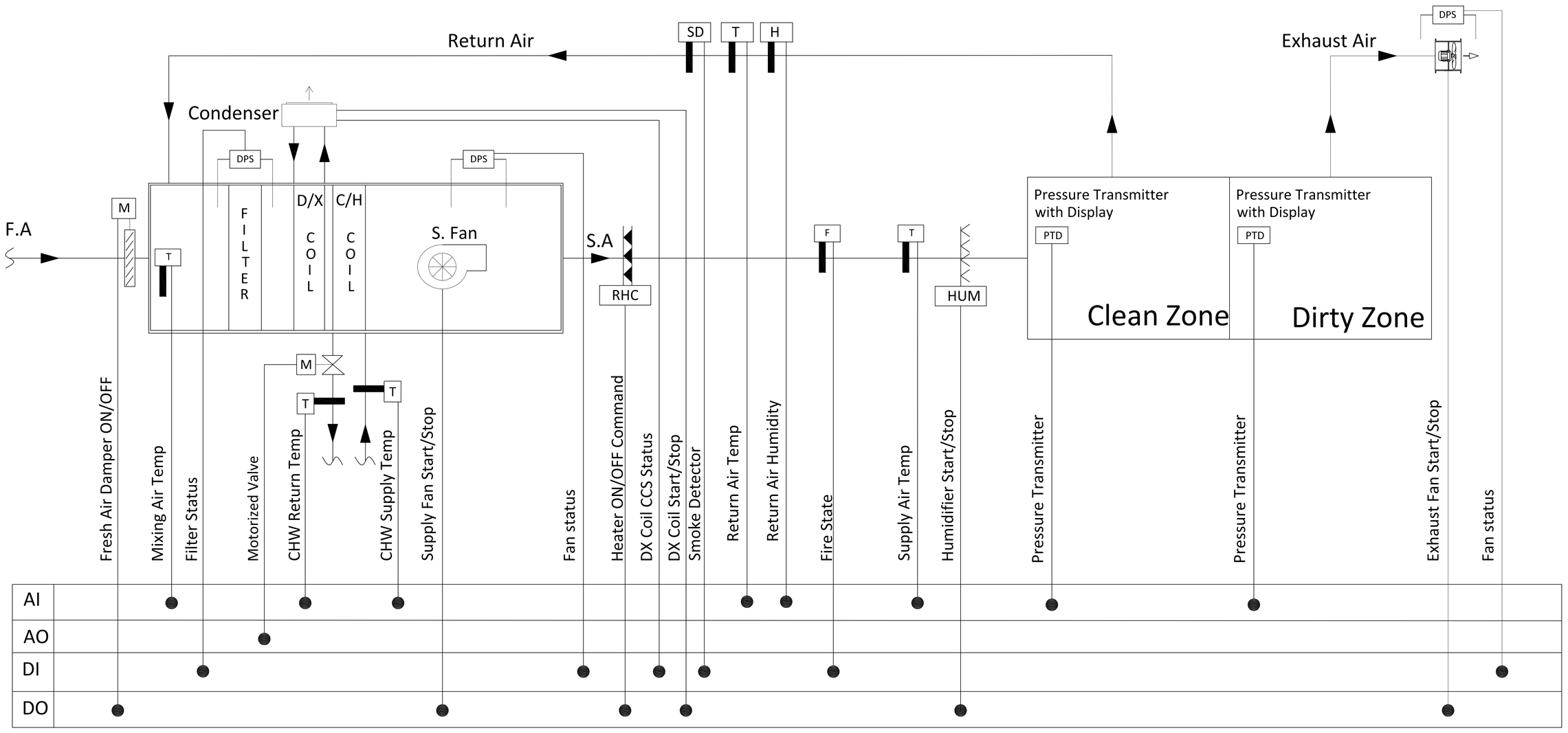
1. The microprocessor controller shall be standalone with BACnet Protocol.
2. The Air-handling unit fan shall be started and stopped from Operator workstation and also on time schedule.
3. Differential pressure switch across the fan shall monitor air flow status, in case of airflow failure the fan shall switched off and failure alarm show at Operator Workstation.
4. Differential pressure switch across filter shall provide dirty filter alarm at Operator Workstation .
5. Space temperature shall be maintained constant at user defined set point, by sensing return air temperature and modulating Motorized 2-way valve through microprocessor based controller..
6. Smoke Detector in exhaust air duct shall monitor smoke, in case of smoke in exhaust air duct, fans shall be switched off, Motorized 2 way-valve shall be forced to close position and alarm shall be initiated at Operator Workstation
7. In case of high temperature in supply air duct sense by firestat, the unit shall be switch off, controll valve shall be force to off position and alarm shall be displayed of workstation .
8. Motorized fresh air damper shall be interlocked with Fan command.
9. The Condenser (for DX Coil) shall be started and stopped from Operator workstation.
10. Status of Condenser (for DX Coil) shall be monitor at Operator Workstation.
11. Status of Exhaust air fan shall be monitor at Operator Workstation.
12. Status of Exhaust air fan shall be started and stopped from Operator Workstation.
13. Exhaust air fan shall be interlock AHU Fan.
14. Electrical Reheat Coil shall be use for Heating & De-humidification purpose.
15. Motorized 2 way -valve shall be forece to fully open position in De-humidification mode while Electrical Duct Heater shall maintain supply air temperature.
16. Motorized 2 way -valve shall be forece to off position and duct heater shall be operate on sudden Heating command.
17. Electrical duct heater shall be interlock with Fan.
18. Condenser (for DX Coil) shall be interlock with Fan.
19. Incase of low humidity the Humidifier shall operate to maintain required humidity level .
20. Following data shall be displayed at Operator Workstation:

- Return Air Temperature
- Return Air Humidity
- Supply Air Temperature
- Temp Set point
- Valve Positions
- Filter Status
- Supply Fan Status & Alarm
- Condenser Status
- Smoke Detector Status
- Fire Stat Alarm

NOTES:
1) Controller shall be selected with 20% spare I/O's.
2) BMS shall be provided with lifetime Software.
3) All wiring and conduiting (including power & communication) shall be in scop of Supplier.
4) Installation / location of sensors and controller shall be according to environment conditions.

LEGENDS	
T	Temperature Sensor
H	Humidity Sensor
M	Motorized Valve
DPS	Differential Pressure Switch
VFD	Variable Frequency Drive
PTD	Pressure Transmitter with Display
P	Pump
CH	Chiller
S.Fan	Supply Air Fan
D/X	Direct Expanssion
C/H	Chilled Water
SA	Supply Air
FA	Fresh Air
Heater	Electric Duct Heater
M	Motorized Damper
F	Fire State
SD	Smoke Detector
PT	Programable Thermostat

PROJECT: MTI (MEDICAL TEACHING INSTITUTE) PESHAWAR INSTITUTE OF **CARDIOLOGY** **HAYATABAD,PESHAWAR**	PREPARED BY : I.A	DATE:	28-9-2022
	DRAWN BY: M.A.T	JOB # :	---
JOB TITLE: HVAC BMS & TEMPERATURE CONTROL DIAGRAM FOR OT AHU's 1 & 2	CHECKED BY: I.A	SCALE :	N.T.S
	APPROVED BY : I.A	DRAWING # :	HVAC-05



Schematic Diagram for CSSD Air Handling unit 3

SEQUENCE OF OPERATION

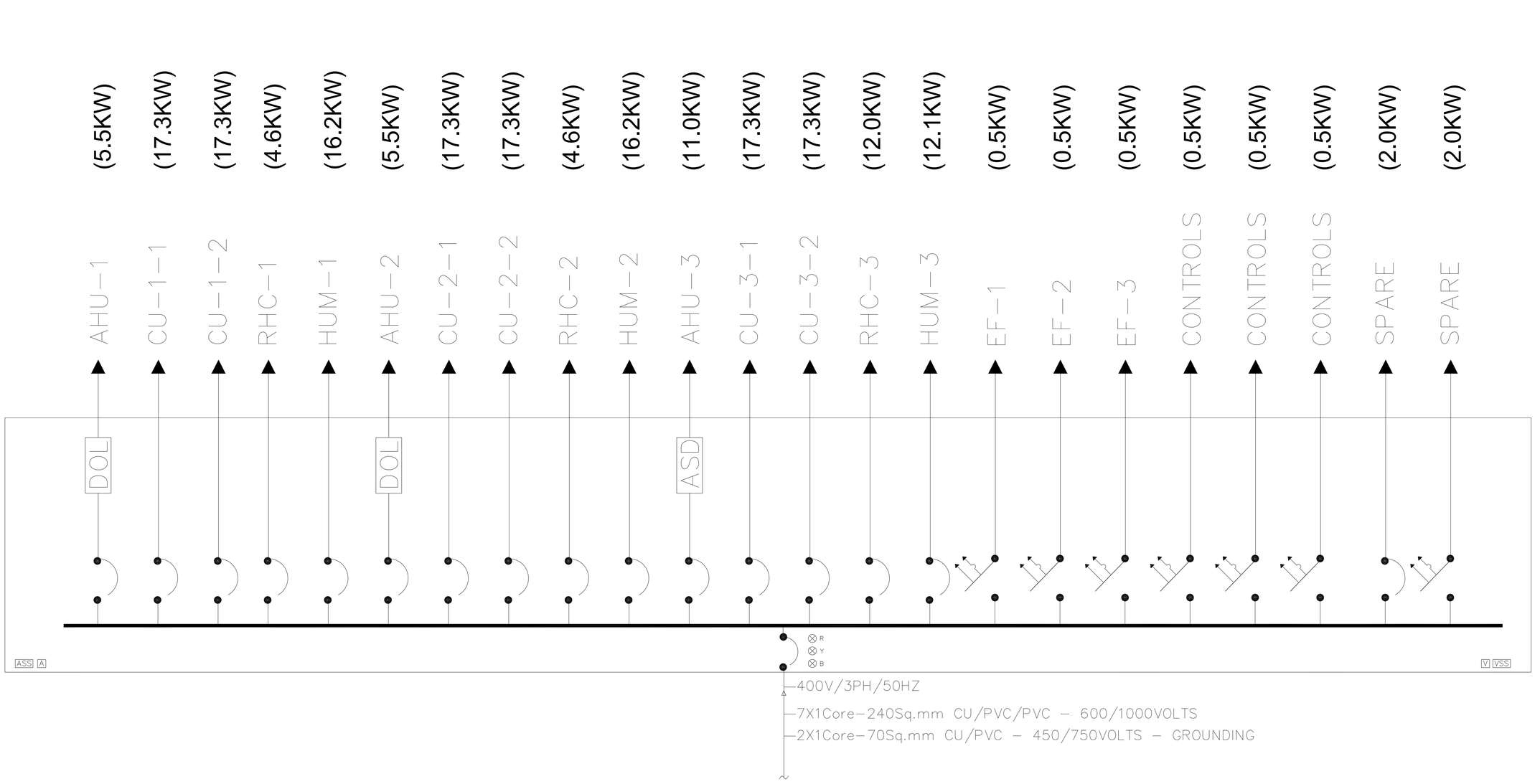
1. The microprocessor controller shall be standalone with BACnet Protocol.
2. The Air-handling unit fan shall be started and stopped from Operator workstation and also on time schedule.
3. Differential pressure switch across the fan shall monitor air flow status, in case of airflow failure the fan shall switched off and failure alarm show at Operator Workstation.
4. Differential pressure switch across filter shall provide dirty filter alarm at Operator Workstation .
5. Space temperature shall be maintained constant at user defined set point, by sensing return air temperature and modulating Motorized 2-way valve through microprocessor based controller..
6. Smoke Detector in exhaust air duct shall monitor smoke, in case of smoke in exhaust air duct, fans shall be switched off, Motorized 2 way-valve shall be forced to close position and alarm shall be initiated at Operator Workstation
7. In case of high temperature in supply air duct sense by firestat, the unit shall be switch off, controll valve shall be force to off position and alarm shall be displayed of workstation .
8. Motorized fresh air damper shall be interlocked with Fan command.
9. The Condenser (for DX Coil) shall be started and stopped from Operator workstation.
10. Status of Condenser (for DX Coil) shall be monitor at Operator Workstation.
11. Status of Exhaust air fan shall be monitor at Operator Workstation.
12. Status of Exhaust air fan shall be started and stopped from Operator Workstation.
13. Exhaust air fan shall be interlock AHU Fan.
14. Electrical Reheat Coil shall be use for De-humidification purpose.
15. Motorized 2 way-valve shall be forece to fully open position in De-humidification mode while Electrical Duct Heater shall maintain supply air temperature.
16. Electrical duct heater shall be interlock with Fan.
17. Condenser (for DX Coil) shall be interlock with Fan.
18. Incase of low humidity the Humidifier shall operate to maintain required humidity level .
19. Following data shall be displayed at Operator Workstation:

- Return Air Temperature
- Return Air Humidity
- Supply Air Temperature
- Temp Set point
- Valve Positions
- Filter Status
- Supply Fan Status & Alarm
- Condenser Status
- Smoke Detector Status
- Fire Stat Alarm

NOTES:
1) Controller shall be selected with 20% spare I/O's.
2) BMS shall be provided with lifetime Software.
3) All wiring and conduiting (including power & communication) shall be in scop of Supplier.
4) Installation / location of sensors and controller shall be according to environment conditions.

LEGENDS	
T	Temperature Sensor
H	Humidity Sensor
M	Motorized Valve
DPS	Differential Pressure Switch
VFD	Variable Frequency Drive
PTD	Pressure Transmitter with Display
P	Pump
CH	Chiller
S.Fan	Supply Air Fan
D/X	Direct Expanssion
C/H	Chilled Water
SA	Supply Air
FA	Fresh Air
Heater	Electric Duct Heater
M	Motorized Damper
F	Fire State
SD	Smoke Detector
PT	Programable Thermostat

PROJECT: MTI (MEDICAL TEACHING INSTITUTE) PESHAWAR INSTITUTE OF **CARDIOLOGY** **HAYATABAD,PESHAWAR**	PREPARED BY :	I.A	DATE: 28-9-2022
	DRAWN BY:	M.A.T	JOB # : ---
JOB TITLE: HVAC BMS & TEMPERATURE CONTROL DIAGRAM FOR CSSD AHU 3	CHECKED BY:	I.A	SCALE : N.T.S
	APPROVED BY :	I.A	DRAWING # : HVAC-06



ACP/1 (198.5KW)

OUTSIDE

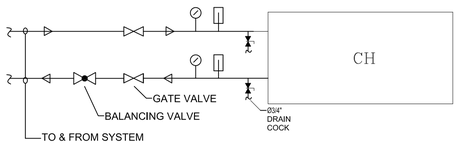
[LOCATION: AT ROOFTOP]

MAIN PANEL

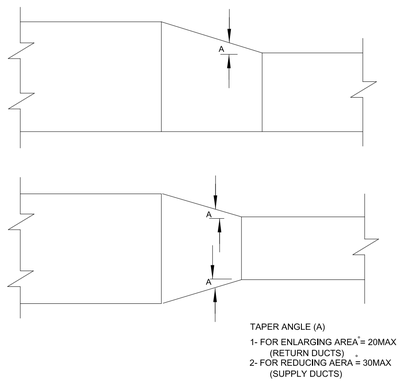
WEATHERPROOF PANEL

NOTE: POWER SUPPLY FROM MAIN PANEL OF HVAC PLANT ROOM

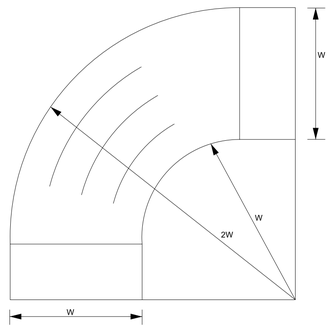
PROJECT: MTI (MEDICAL TEACHING INSTITUTE) PESHAWAR INSTITUTE OF **CARDIOLOGY** **HAYATABAD,PESHAWAR**	PREPARED BY :	I.A	DATE:	28-9-2022
	DRAWN BY:	M.A.T	JOB # :	---
JOB TITLE: HAVC ELECTRICAL DISTRIBUTION DRAWING	CHECKED BY:	I.A	SCALE :	N.T.S
	APPROVED BY :	I.A	DRAWING # :	HVAC-08



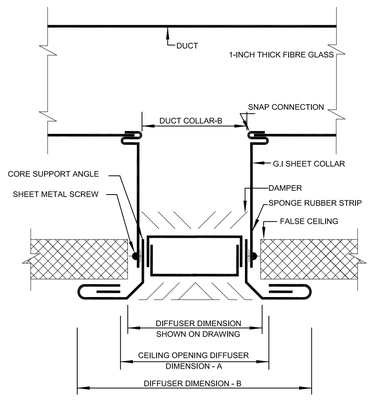
PIPING INSTALLATION DETAIL AT CHILLER



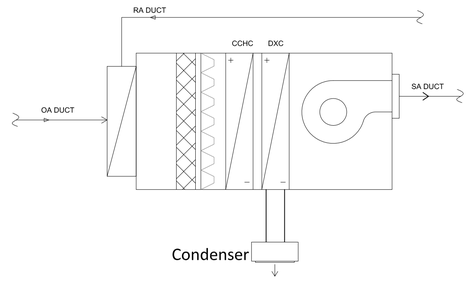
DUCT TRASITION FABRICATION



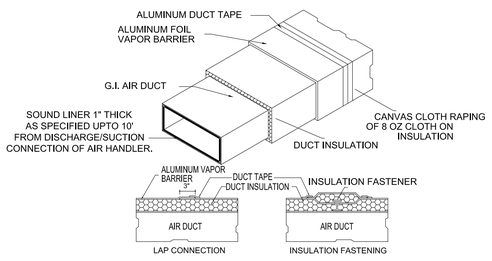
RADIUS ELBOW



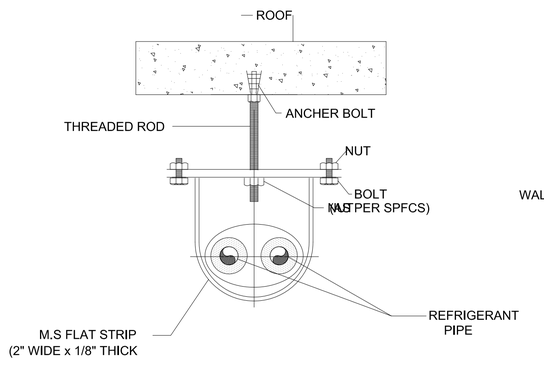
DIFFUSER INSTALLATION



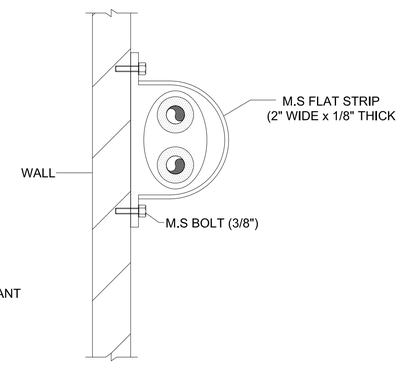
ALL AHUs CONFIGURATION
[PF+BAG FILTER+CCHC+DXC & FAN SECTION]



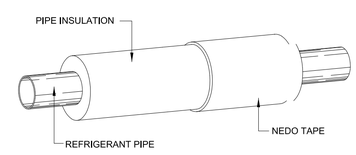
DUCT INSULATION DETAIL



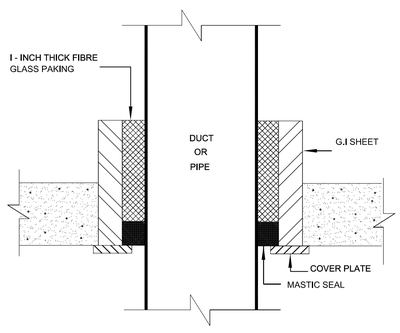
REFRIGENT PIPES DETAILS



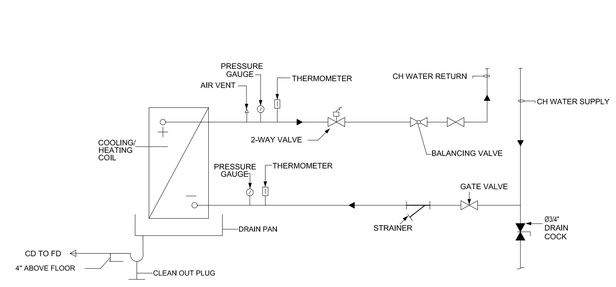
PIPE INSULATION FOR EXTERNAL REFRIGERANT PIPE



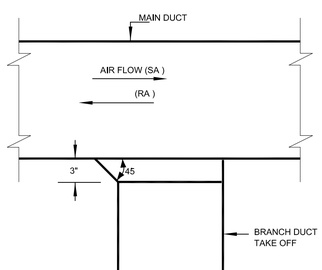
PIPE INSULATION DETAIL



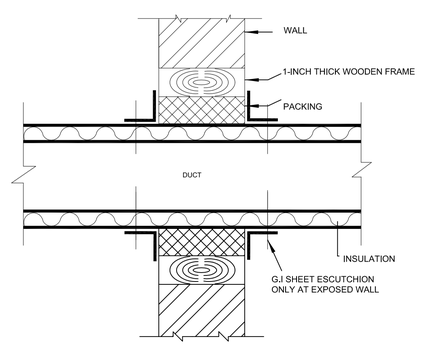
DUCT OR PIPE THRU ROOF



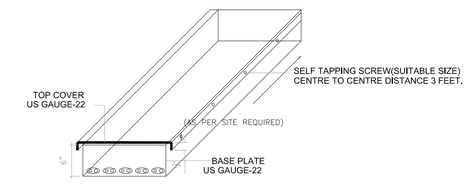
PIPING DETAIL AT ALL AHUs



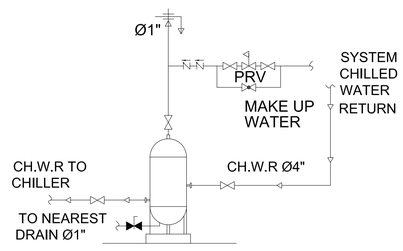
BRANCH DUCT TAKE OFF



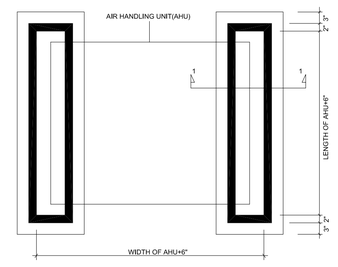
DUCT THRU WALL

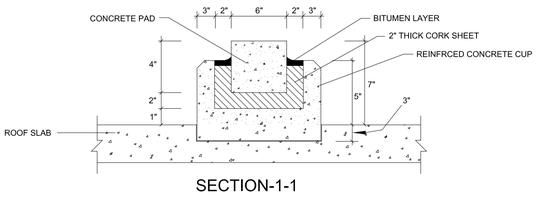


TRUNKING DETAILS FOR EXPOSED COPPER PIPES
(NEAR OUTDOOR CONDENSING UNITS)

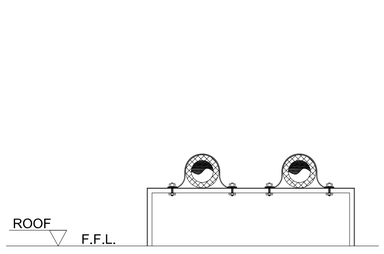


SCHEMATIC LAYOUT OF
EXPANSION TANK

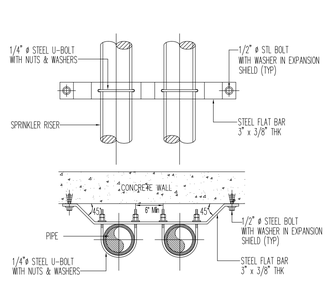




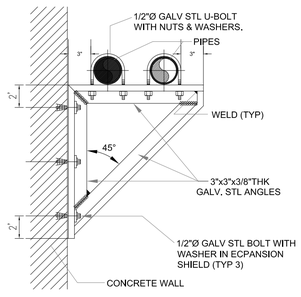
AHU INSTALLATION & FOUNDATION DETAIL



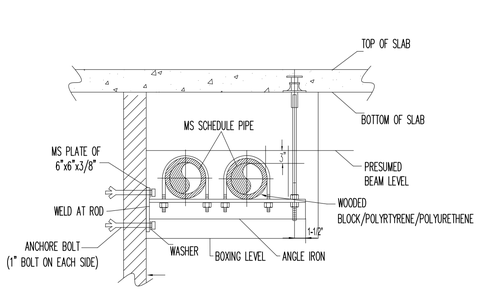
TYP-A



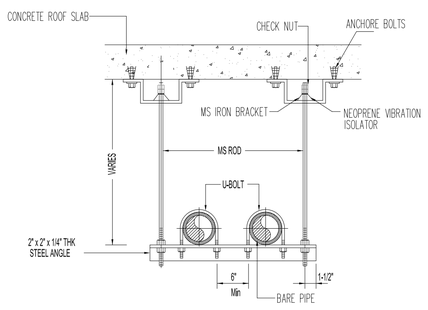
TYP-B



TYP-C



TYP-D



TYP-E

TYPICAL PIPE SUPPORT DETAILS

PROJECT: MTI (MEDICAL TEACHING INSTITUTE) PESHAWAR INSTITUTE OF **CARDIOLOGY** **HAYATABAD,PESHAWAR**	PREPARED BY : I.A	DATE:	28-9-2022
	DRAWN BY: M.A.T	JOB # :	---
JOB TITLE: HVAC STANDARD DETAIL'S	CHECKED BY: I.A	SCALE :	N.T.S
	APPROVED BY : I.A	DRAWING # :	HVAC-07

Annexure-B

PESHAWAR INSTITUTE OF CARDIOLOGY, PESHAWAR

SCHEDULES FOR AIR HANDLING UNITS (AHU) - EUROVENT & HYGIENIC CERTIFIED

AHU CODE	AREA SERVED	TYPE	AHU CONFIGURATION	QTY.	SUPPLY FAN AIR FLOW (CFM)	SUPPLY FAN EXT. SP (Inch)	OUTDOOR AIR (OA) (CFM)	RETURN AIR (RA) (CFM)	SUPPLY FAN DISCH ARR.	COOLING AIR SIDE CHILLED WATER AND DX COIL TC (MBH)	SC (MBH)	EDB (ºF)	EWB (ºF)	COOLING WATER SIDE EWT (ºF)	MAX. FLOW RATE (US GPM)	MAX. PRESS DROP (FT OF WATER)	REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	23
AHU - 1	OT-3 FIRST FLOOR	HYGIENIC, SINGLE ZONE, HORIZONTAL DRAW THROUGH, DOUBLE SKIN, DUEL COIL, FLOOR MOUNTED, OUTDOOR TYPE	Pre Filter (G4), BAG Filter (90 %), Chilled Water Coil, DX Coil & Fan Section	1	1984	3.53	1984	0	FD	240.78	132.20	113	84	44	48.16	20	SEE NOTES
AHU - 2	OT-4 FIRST FLOOR	--DO--	--DO--	1	1984	3.53	1984	0	FD	240.85	133.20	113	84	44	48.17	20	SEE NOTES
AHU - 3	CSSD SECOND FLOOR	--DO--	Mixing Box, Pre Filter (G4), BAG Filter (90 %), Chilled Water Coil, DX Coil & Fan Section	1	5169	1.70	1424	3745	FD	273.20	175.50	81.3	66.6	44	54.64	20	SEE NOTES

LEGENDS:

AHU	AIR HANDLING UNITS	EAT	ENTERING AIR TEMPERATURE
CFM	CUBIC FEET/MINUTE	EDB	ENTERING DRY BULB TEMPERATURE
HDT	HORIZONTAL DRAW THRU	EWB	ENTERING WET BULB TEMPERATURE
FPM	FEET PER MINUTE	EWT	ENTERING WATER TEMPERATURE
UB	UP BLAST	USGPM	UNITED STATES GALLON PER MINUTE
FD	FRONT DISCHARGE	SC	COIL SENSIBLE COOLING
SP	STATIC PRESSURE	TC	COIL TOTAL COOLING
OV	OUTLET VELOCITY	OA	OUTDOOR AIR

NOTES:

1. FAN SHOULD BE SELECTED FOR TOTAL STATIC PRESS.= ESP+AHU SP+ FILTER PRESS. LOSSES (MFR. RECOMMENDED DIRTY & CLI
2. MOTOR HP SHALL BE AT LEAST 120 % OF REQUIRED BHP.
3. COIL FACE VELOCITY SHALL BE 550 FPM (MAXIMUM).
4. SUPPLY FAN DISCHARGE VELOCITY SHALL BE 2000FPM (MAXIMUM).
5. AHUs SHALL BE OUTDOOR TYPE AND SHALL BE PROVIDED WITH ROOF CANOPY
6. AHUs SHALL BE PROVIDED WITH SS (STAINLESS STEEL) INNER SKIN & DRAIN PANS.
7. FAN SECTION SHALL BE PROVIDED WITH LIGHT, SIGHT GLASS AND EMERGENCY STOP BUTTON.
8. BOTH COILS (CHILLED WATER & DX) SHALL BE EPOXY COATED
9. AHUs SHALL BE HYGIENIC CERTIFIED FROM REPUTABLE INSTITUTE
10. MINIMUM ENERGY EFFICIENCY OF MOTOR SHALL BE IE-3
11. MOTOR SHALL HAVE MINIMUM PROTECTION OF IP-55 WITH CHASS-F INSULATION.

PESHAWAR INSTITUTE OF CARDIOLOGY, PESHAWAR

SCHEDULE FOR AIR INLETS / OUTLETS

1	CODE	**SAD**	**RAD**	**EAD**	**SAR/FAR**	**RAG/EAG**	**W**	**L**
2	TYPE	SUPPLY AIR DIFFUSERS	RETURN AIR DIFFUSERS	EXHAUST AIR DIFFUSERS	SUPPLY AIR REGISTERS	RETURN AIR GRILLE	BELL MOUTH	FRESH/EXHAUST AIR LOUVERS
3	SERVICE	SUPPLY	RETURN	EXHAUST	SUPPLY	RETURN / EXHAUST	REURN/ EXHAUST	FRESH/EXHAUST AIR
4	MATERIAL	EXTRUDED ALUMINUM	EXTRUDED ALUMINUM	EXTRUDED ALUMINUM	EXTRUDED ALUMINUM	EXTRUDED ALUMINUM	G.I	EXTRUDED ALUMINUM
5	WITH DAMPER	YES	YES	YES	YES	NO	AS SHOWN ON DRG.	NO
6	FINISH	POWDER COATED	POWDER COATED	POWDER COATED	POWDER COATED	POWDER COATED	GALVANIZED	POWDER COATED
7	COLOUR	AS REQD. BY ENGR.	AS REQD. BY ENGR.	AS REQD. BY ENGR.	AS REQD. BY ENGR.	AS REQD. BY ENGR.	AS REQD. BY ENGR.	AS REQD. BY ENGR.
8	REMARKS	--	--	--	--	--	WITH INSECT SCREEN	--

PESHAWAR INSTITUTE OF CARDIOLOGY, PESHAWAR

SCHEDULES FOR VENTILATION FANS

CODE	TYPE	SERVICE	AREA SERVED	QTY.	AIR FLOW (CFM)	EXTERNAL SP (IN.WC)	MAX. OV (FPM)	DRIVE	MAX. FAN MOTOR RPM	MOTOR		ACCESSORIES
										POWER RATING (V/Ph/Hz)	HP	
1	2	3	4	5	6	7	8	9	10	11	12	13
EF-1	CENTRIFUGAL IN-LINE	EXHAUST AIR	OT-3 WITH AHU-3	1	1784	1	2000	DIRECT	1440	220/1/50	--	--
EF-2	CENTRIFUGAL IN-LINE	EXHAUST AIR	OT-4 WITH AHU-4	1	1784	1	2000	DIRECT	1440	220/1/50	--	--
EF-3	CENTRIFUGAL IN-LINE	EXHAUST AIR	CSSD	1	1527	1	2000	DIRECT	1440	220/1/50	--	--

NOTES :-

1. SOUND POWER LEVEL OF ALL FANS AT DISCHARGE SHALL NOT EXCEED 75 db.

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SCHEDULE FOR FILTERS

1	CODE	F
2	SERVICE	OUTDOOR AIR
3	TYPE OF FILTER BOX	DUCT MOUNTED
4	THICKNESS (IN)	2
5	CFM	AS SHOWN ON DRAWING
6	MAX. FACE VELOCITY (FPM)	500
7	NO. OF SECTION	AS REQUIRED
8	SIZE OF EACH SECTION (MAX) (IN * IN)	AS SHOWN ON DRAWING
	NO. OF FILTER	AS SHOWN ON DRAWING
9	MAKE	
	a) FILTER BOX	NA
	b) FILTER MEDIA	LOCAL
10	COUNTRY OF MANUFACTURE	
	a) FILTER BOX	LOCAL
	b) FILTER MEDIA	LOCAL
11	MAX. PD (CLEAN) IN. WG	0.05
12	TYPE OF FILTER	WASHABLE METALLIC
13	EFFICIENCY	AS SPECIFIED
14	REMARKS	--

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SCHEDULE FOR STEAM HUMIDIFIERS

CODE	TYPE	QTY	EVAPORATION RATE (LB/HR)	POWER SUPPLY	REMARKS
1	2	3	4		5
HUM-1	DUCT MOUNTED TYPE SELF CONTAINED ELECTRIC RESISTANCE STEAM HUMIDIFIER	1	34.14	3PH-415V-50HZ	--
HUM-2	--DO--	1	34.04	3PH-415V-50HZ	--
HUM-3	--DO--	1	24.25	3PH-415V-50HZ	--

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SCHEDULE FOR DUCT RE-HEAT COILS

CODE	TYPE	QTY	AIR FLOW (CFM)	HEATING CAPACITY (KW)	NO. OF STAGES (NO.)	POWER SUPPLY	REMARKS
1			3	4	5	6	8
RHC-1	TUBE TYPE SUPPORTED IN METAL FRAME	1	1984	4.6	2	3PH-415V-50HZ	--
RHC-2	--DO--	1	1984	4.6	2	3PH-415V-50HZ	--
RHC-3	--DO--	1	5169	12.0	3	3PH-415V-50HZ	--

LEGEND

RHC	RE-HEAT COIL
CFM	CUBIC FEET/MINUTE
V	VOLTS
PH	PHASE
HZ	HERTZ
KW	KILOWATTS

NOTES

1- THE ELECTRICAL DUCT HEATERS SHALL BE SUPPLIED COMPLETE WITH HIGH TEMPERATURE LIMIT THERMOSTAT FOR SAFETY.

2- THE ELECTRICAL DUCT HEATERS SHALL BE SUPPLIED COMPLETE WITH STAGE CONTACTORS.

3- THE DUCT HEATERS SHALL BE INTERLOCKED WITH THE FAN MOTORS OF THE RESPECTIVE AHU