STANDARD BIDDINGDOCUMENT

EQUIPMENT AND MACHINERY

FAISALABAD INSTITUTE OF CARDIOLOGY, FAISALABAD.

Table of Contents

A. Instructions to Bidders (ITB)

General Instructions:

1. Content of Bidding Document

1.1 The goods required, bidding procedures, and Contract terms are prescribed in the bidding documents. In addition to the Invitation for Bids, the bidding documents include:

- **(a)** Instructions to Bidders(ITB);
- **(b)** General Conditions of Contract(GCC);
- **(c)** Special Conditions of Contract(SCC);
- **(d)** Schedule of Requirements;
- **(e)** Technical Specifications;
- **(f)** Contract Form;
- **(g)** Manufacturer's Authorization Form;
- **(h)** Performance Guaranty Form;
- **(i)** Bid Form; and
- **(j)** Price Schedule

1.2 The "Invitation for Bids" does not form part of the Bidding Documents and is included as a reference only. In case of discrepancies between the Invitation for Bid and the Bidding Documents listed in 1.1 said Bidding Documents shall take precedence.

1.3 The Bidder is expected to examine all instructions, forms, terms, and specifications in the bidding documents. Failure to furnish all information required by the bidding documents or to submit a bid not substantially responsive to the bidding documents in every respect shall be at the Bidder's risk and may result in the rejection of its bid.

2. Source of Funds

2.1 Government of Punjab.

3. Eligible Bidders

3.1 This Invitation for Bids is for prequalified firms for who were declared prequalified by Faisalabad Institute of Cardiology, Faisalabad.

4. Eligible Goods and Services

4.1 Country of manufacturer should be of USA, Europe and Japan; unless otherwise any other country of manufacturer is mentioned in specifications. However, country of origin of equipment could be from any geographical region of the world as per laws of Pakistan.

4.2 For the purpose of this clause, (a) the term "Goods" includes any Goods that are the subject of this Invitation for Bids and (b) the term "Services" includes related services such as transportation, insurance, after sale service, spare parts availability, etc. For purposes of this clause, "origin" means the place where the goods are mined, grown, or produced, or the place from which the related services are supplied. In case of the "manufacturer" the "origin" means the firm is based and registered in that country and registered with their stock exchange. Goods

are produced when, through manufacturing or processing, or substantial and major assembly of components, a commercially recognized product is produced that is substantially different in basic characteristics or in purpose or utility from its components.

5. Cost of Bidding

5.1 The Bidder shall bear all costs associated with the preparation and submission of its bid, and the Procuring Agency shall in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

6. Clarification of Bidding Documents

6.1 A prospective Bidder requiring any clarification of the bidding documents may notify the Procuring Agency in writing at the Procuring Agency's address indicated in the Invitation for Bids. The Procuring Agency shall respond in writing to **any request for clarification of the bidding documents, which it receives not later than seven (07)** days prior to the deadline for the submission of bids prescribed in the Invitation for Bids. Written copies of the Procuring Agency's response (including an explanation of the query but without identifying the source of inquiry) shall be sent to all prospective Bidders that have received the bidding documents.

7. Amendment of Bidding Documents

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

7.2 All prospective Bidders that have received the bidding documents shall be notified of the amendment in writing, and shall be binding on them.

7.3 In order to allow prospective Bidders reasonable time in which to take the amendment into account in preparing their bids, the Procuring Agency, at its discretion, may extend the deadline for the submission of bids. Amendment notice to that effect shall be communicated in the same manner as the original invitation to bid.

8. Corrupt or Fraudulent Practices

8.1 The Procuring Agency requires that all Bidders/ Suppliers/ Contractors observe the highest standard of ethics during the procurement and execution of such Contracts. In pursuance of rule 2 (P) of PPRA 2014 and its subsequent amendments, if any , the Procuring Agency:

a. defines, for the purposes of this provision, the terms set forth below as follows:

(i) **coercive practice** by impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence the actions of a party to achieve a wrongful gain or to cause a wrongful loss to another party;

(ii) **collusive practice** by arrangement between two or more parties to the procurement process or contract execution, designed to achieve with or without the knowledge of the procuring agency to establish

Prices at artificial, noncompetitive levels for any wrongful gain;

(iii) **corrupt practice** by offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence the acts of another party for wrongful gain;

(iv) **fraudulent practice** by any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

(v) **obstructive practice** by harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in a procurement process, or affect the execution of a contract or deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements before investigators in order to materially impede an investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or acts intended to

materially impede the exercise of inspection and audit rights.

b. shall reject a proposal for Award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the Contract in question; shall declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a Contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, a Contract.

Preparation of Bids

9. Language of Bid

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

10. Documents Comprising the Bid

10.1 The bid prepared by the Bidder shall comprise the following components:

(a) A Bid Form and Price Schedule completed in accordance with ITB Clauses 12 and 13 (to be submitted along with financial proposal);

(b) Documentary evidence established in accordance with ITB Clause 15 that the Bidder is eligible to bid and is qualified to perform the Contract if its bid is accepted;

(c) Documentary evidence established in accordance with ITB Clause 15 that the goods to be supplied by the Bidder are eligible goods and conform to the bidding documents.

11. Bid Form and Price Schedule

11.1 The Bidder shall complete the Bid Form and an appropriate Price Schedule furnished in the bidding documents (Annexure A Form), indicating the goods to be supplied, a brief description of the goods, specifications, taxes, quantity, prices, make, model, country of origin, country of manufacturer and port shipment.

12. Bid Prices

12.1 The Bidder shall indicate on the Price Schedule the unit prices and total Package Price of the goods, it proposes to supply under the Contract.

12.2 Form for Price Schedule is to be filled in very carefully, and should be typed. Any alteration/ correction must be initialed. Every page is to be signed and stamped at the bottom. Serial number/ bid number of the quoted item may be marked or highlighted with red/yellow marker.

12.3 The Bidder should quote the prices on CI&F / FOR of goods. The specifications of goods, different from the demand of enquiry and packaged items, shall straightway be rejected.

12.4 The Bidder is required to offer competitive price. All prices must include relevant taxes and duties, where applicable. If there is no mention of taxes, the offered/ quoted price shall be considered as inclusive of all prevailing taxes/duties. The benefit of exemption from or reduction in the GST or other taxes shall be passed on to the Procuring Agency.

12.5 Prices offered should be for complete package/Tender with accessories; detail of which is already mentioned in the technical specifications.

12.6 While tendering your quotation, the present trend/ inflation in the rate of goods and services in the market should be kept in mind. No request for increase in price due to market fluctuation in the cost of goods and services shall be entertained after the bid has been submitted.

13. Bid Currencies

13.1 In case of CI&F tender, the Prices shall be quoted in $/£/€/¥/CHF.

13.2 State Bank of Pakistan's foreign currency selling rate will be considered from the date of opening of financial bid for comparison purposes.

13.3 The price for complete package/Tender, standard accessories; detail of which is already mentioned in the technical specifications will be considered for determining the lowest bidder.

Optional items will not be considered while determining the lowest bidder.

14. Documents Establishing Bidder's Eligibility and Qualification

14.1 The Bidder shall furnish, as part of its technical bid, documents establishing the Bidder's eligibility to bid and its qualifications to perform the Contract if its bid is accepted.

14.2 The documentary evidence to be submitted in the Technical Proposal for the purposes of qualification and technical evaluation shall include:

(a) The Supplier/ agent shall have to produce letter of authorization from Manufacturer or joint venture/ consortium/ alliance of the local Sole agents/manufacturers.

15. Documents Establishing Goods' Eligibility and Conformity to Bidding Documents

15.1 Pursuant to ITB Clause 11, the Bidder shall furnish along with technical proposal, as part of its bid, documents establishing the eligibility and conformity to the bidding documents of all goods, which the Bidder proposes to supply under the Contract.

15.2 The documentary evidence of the eligibility of the goods shall consist of a statement in the Price Schedule of the country of origin of the goods offered.

15.3 Submission of sample if so required by the Technical Committee; the bidder shall provide the sample or give demonstration as per requirement for evaluation/ satisfaction of the Committee.

15.4 Alternative bid is not allowed also a bidder cannot submit two bids. If the bidder quotes an alternative bid or submit two bids then the bidder will be considered as non-responsive.

16. Bid Validity

16.1 Bids shall remain valid for a period of 90 days after opening of Technical Bid prescribed by the Procuring Agency. A bid valid for a shorter period shall be rejected by the Procuring Agency as non-responsive.

16.2 The Procuring Agency shall ordinarily be under an obligation to process and evaluate the bid within the stipulated bid validity period. However, under exceptional circumstances and for reasons to be recorded in writing, if an extension is considered necessary, all those who have submitted their bids shall be asked to extend their respective bid validity period. Such extension shall be for not more than the period equal to the period of the original bid validity. Such extension shall not be for more than the period equal to the period of the original bid validity.

16.3 Bidders who,

(a) agree to the Procuring Agency's request for extension of bid validity period shall not be permitted to change the substance of their bids; and

(b) do not agree to an extension of the bid validity period shall be allowed to withdraw their bids, if any.

Submission of Bids

17. Format and Signing of Bid

17.1 The bid shall be typed and shall be signed by the Bidder or Lead Bidder (in case of tender with the permission of alliance/ Joint venture for the bidding of complete package i.e. more than one equipment in a single tender) or a person or persons duly authorized to bind the Bidder to the Contract. The person or persons signing the bid shall initial all pages of the bid.

17.2 Any interlineations, erasures, or overwriting shall be valid only if they are initialed by the person or persons signing the bid.

17.3 All biding documents to be duly attested (signed and stamped) by the authorized person of bidder.

18. Sealing and Marking of Bids

18.1 The envelopes shall be marked as "FINANCIAL PROPOSAL" and "TECHNICAL PROPOSAL" in bold and legible letters to avoid confusion. The envelopes shall then be sealed in an outer envelope. It should contain the package name and its number.

18.2 The inner and outer envelopes shall:

a) be addressed to the Procuring Agency at the address given in the Invitation for Bids;

and

b) bear the Institution/Hospital name and number indicated in the Invitation for Bids, and shall be inscribed by the following sentence: "D O NOT OP EN BEFORE," tobe completed with the time and the date specified in the invitation for Bid.

18.3 The inner envelopes shall also indicate the name and address of the Bidder/ Lead Bidder to enable the bid to be returned unopened in case it is declared as non-responsive or late.

18.4 If the outer as well as inner envelope is not sealed and marked properly, the Procuring Agency shall assume no responsibility for the bid's misplacement or premature opening.

19. Deadline for Submission of Bids

19.1 Bids must be submitted by the Bidder and received by the Procuring Agency at the address specified under ITB Clause 19.1 not later than the time and date specified in the Invitation for Bids.

19.2 The Procuring Agency may, at its discretion, extend this deadline for the submission of bids by amending the bidding documents in accordance with ITB Clause 7 , in which case all rights and obligations of the Procuring Agency and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

20. Late Bid

20.1 Any bid received by the Procuring Agency after the deadline for submission of bids prescribed by the Procuring Agency pursuant to ITB Clause 21 shall be rejected and returned unopened to the Bidder.

21. Withdrawal of Bids

21.1 The Bidder may withdraw its bid prior to the deadline specified in the invitation tobid.

21.2 No bid may be withdrawn in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified in ITB Clause 18.2 Withdrawal of a bid during this interval will make the bidder eligible to be debarred for further procurements for a period as deem necessary by the Procuring Agency.

The Bidding Procedure

22. Single stage – two envelopes bidding procedure

22.1 Single stage – two envelopes bidding procedure shall be applied:

(i) The bid shall comprise a single package containing two separate envelopes. Each envelope shall contain separately the financial proposal and the technical proposal;

(ii) the envelopes shall be marked as "FINANCIAL PROPOSAL" and "TECHNICAL PROPOSAL" in bold and legible letters to avoid confusion;

(iii) initially, only the envelope marked "TECHNICAL PROPOSAL" shall be opened;

(iv) the envelope marked as "FINANCIAL PROPOSAL" shall be retained in the custody of Procuring Agency without being opened;

(v) the Procuring Agency shall evaluate the technical proposal, without reference to the price and reject any proposal which do not conform to the specified requirements;

(vi) during the technical evaluation no amendments in the technical proposal shall be permitted;

(vii) the financial proposals of bids shall be opened publicly at a time, date and venue to be announced and communicated to the Bidders in advance;

(viii) After the evaluation and approval of the technical proposal the Procuring Agency shall at a time within the bid validity period, publicly open the financial proposals of the technically accepted bids only. The financial proposal of bids found technically non-responsive shall be returned un-opened to the respective Bidders; and

(ix) The bid found to be the lowest evaluated bid shall be accepted.

(x) The procuring agency may adopt any other bidding procedure depending on the nature of procurement / Type of Goods / Equipment to be procured as per the methods of procurement prescribed in PPRA 2014 and its subsequent amendments, if any.

Opening and Evaluation of Bids

23. Opening of Bids by the Procuring Agency

23.1 The Procuring Agency shall initially open only the envelopes marked "TECHNICAL PROPOSAL in the presence of Bidders' representatives who choose to attend, at the time, on the date, and at the place specified in the Invitation for Bids. The Bidders' representatives who are present shall sign the Attendance Sheet as evidence of their attendance. However, the envelope marked as "FINANCIAL PROPOSAL shall remain unopened and shall be retained in safe custody of the Procuring Agency till completion of the evaluation process.

23.2 The Bidders' names, item(s) for which they quoted their rate and such other details as the Procuring Agency, at its discretion, may consider appropriate, shall be announced at the opening of technical proposal. No bid shall be rejected at technical proposal/ bid opening, except for late bids, which shall be returned unopened to the Bidder pursuant to ITB Clause 21. However, at the opening financial proposals (the date, time and venue would be announced later on), the bid prices, discounts (if any), and the presence or absence of requisite bid Security and such other details as the Procuring Agency, at its discretion, may consider appropriate, shall be announced.

23.3 The Procuring Agency shall prepare minutes of both the technical proposal as well as the financial proposal bid opening.

24. Clarification of Bids

24.1 During evaluation of the bids, the Procuring Agency may, at its discretion, ask the Bidder for a clarification of its bid. The request for clarification and the response shall be in writing, and no change in the prices or substance of bid like indication or re-indication of make/model/brand etc. shall be sought, offered, or permitted.

25. Preliminary Examination

25.1 The Procuring Agency shall examine the bids to determine whether they are complete, whether any computational errors have been made (at the time of opening the financial proposal), whether required sureties have been furnished, whether the documents have been properly signed, and whether the bids are generally in order.

25.2 In the financial bids (at the time of opening the financial proposal) the arithmetical errors shall be rectified on the following basis. If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail, and the total price shall be corrected. If the Bidders/Suppliers do not accept the correction of the errors, its bid shall be rejected. If there is a discrepancy between words and figures, the amount in words shall prevail.

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

25.4 Prior to the detailed evaluation, pursuant to ITB Clause 27 the Procuring Agency shall determine the substantial responsiveness of each bid to the bidding documents. For purposes of these Clauses, a substantially responsive bid is one, which conforms to all the terms and conditions of the bidding documents without material deviations. Deviations from, or objections or reservations to critical provisions shall be deemed to be a material deviation for technical proposals. The Procuring Agency's determination of a bid's responsiveness is to be based on the contents of the bid itself without recourse to extrinsic evidence.

25.5 If a bid is not substantially responsive, it shall be rejected by the Procuring Agency and may not subsequently be made responsive by the Bidder by correction of the non conformity.

26. Evaluation and Comparison of Bids

26.1 The Procuring Agency shall evaluate and compare the bids on the basis of Single items/ Complete package (As demanded in the advertised tender), which have been determined to be substantially responsive, pursuant to ITB Clause25.

26.2 The Procuring Agency's evaluation of technical proposal/ bid shall be on the basis of previous performances, test reports, inspection of plant/ factory/ premises, previous experience

of similar contracts, availability of engineering staff and their capabilities, inventory of spare parts, workshop facility to provide the after sales services, financial soundness and such other details as already highlighted. However, the evaluation of financial proposal shall be on the basis of price.

26.3 All bids shall be evaluated in accordance with the evaluation criteria (ITB Clause 29) and other terms and conditions set forth in these bidding documents.

26.4 In case of procurement on CIF basis; for the purpose of comparison of bids quoted in different currencies, the price shall be converted into Pak Rupees in pursuant to ITB Clause 13. The rate of exchange shall be the selling rate, prevailing on the date of opening of Financial Bids specified in the bidding documents, as notified by the State Bank of Pakistan on that day.

26.5 A bid once opened in accordance with the prescribed procedure shall be subject to only those rules, regulations and policies that are in force at the time of issue of notice for invitation of bids.

27. Evaluation Criteria

27.1 For the purposes of determining the lowest evaluated bid, factors other than price such as previous performances, previous experience, engineering/ technical capabilities, repair/ calibration tool, workshop facilities, financial soundness and such other details as the Procuring Agency at its discretion, may consider appropriate shall be taken into consideration and these should be available with the bidder. The following evaluation factors/ criteria will be employed on **technical proposals**.

27.2 Financial proposals would be evaluated as follows:

- **i)** After technical evaluation is completed, the Procuring Agency shall notify the date, time and location for opening of the financial proposals. Bidders' attendance at the opening of financial proposals is optional.
- **ii)** Financial proposals shall be opened publicly in the presence of the bidders' representatives who choose to attend. The name of the bidders shall be read aloud. The financial proposal of the technically responsive bidders shall then be inspected to confirm that they have remained sealed and unopened (financial proposals of technically non-responsive Bidders shall be returned unopened). These financial proposals shall be then opened, and the total prices read aloud and recorded.
- **iii)** Incomplete bid shall stand rejected. All items described in the technical proposal must be priced in financial proposal. Items described in the technical proposal but not priced, shall be assumed to be included in the price of other items.
- **iv)** Minor oversight, clerical mistakes, other minor inconsistencies that do not alter the substances of the financial bid may be corrected by the Procuring Agency. When correcting computation error in case of discrepancy between a partial amount and the total amount or between the words and figures, the formers will prevail.
- **v)** The bidders will quote the Price Schedules. The total price of the system will be calculated by converting the price to single currency (Pak Rs.) on the rate of date of opening of Financial Proposal; in case of import of item.
- **vi)** The lowest responsible bidder will be declared with standard accessories. The price of optional items will not be considered while establishing the lowest bid.

28. Contacting the Procuring Agency

28.1 No Bidder shall contact the Procuring Agency on any matter relating to its bid, from the time of the bid opening to the time the Contract is awarded.

28.2 Any effort by a Bidder to influence the Procuring Agency in its decisions on bid evaluation, bid comparison, or Contract Award will result in the rejection of the Bidder's bid and subsequent black listing. Canvassing by any Bidder at any stage of the Tender evaluation is strictly prohibited.

29. Rejection of Bids

29.1 The Procuring Agency may reject any or all bids at any time prior to the acceptance of a bid. The Procuring Agency shall upon request communicate to any Bidder who submitted a bid, the grounds for its rejection of any or all bids, but is not required to justify those grounds.

29.2 The Procuring Agency incurs no liability, solely by virtue of its invoking Clause 30.1 towards Bidders who have submitted bids.

29.3 Notice of the rejection of any or all bids shall be given promptly to the concerned Bidders that submitted bids.

29.4 The items contained in the tender / package should be bid in total and technical rejection of any item not complying with the technical specifications may lead to the rejection of complete package/Tender.

30. Re-Bidding

30.1 If the Procuring Agency rejects all bids in pursuant to ITB Clause 30, it may call for a re-bidding or if deems necessary and appropriate the Procuring Agency may seek any alternative methods of procurement.

30.2 The Procuring Agency before invitation for re-bidding shall assess the reasons for rejection and may revise specifications, evaluation criteria or any other condition for Bidders, as it may deem necessary.

31. Announcement of Evaluation Report

31.1 The Procuring Agency shall announce the results of bid evaluation of a report giving justification for acceptance or rejection of bids at least ten days prior to the award of procurement Contract.

Award of Contract

32. Acceptance of Bid and Award criteria

32.1 The Bidder with technically evaluated lowest financial bid, if not in conflict with any other law, rules & regulations, policy of the Government or having less Bid Security shall be awarded the Contract, within the original or extended period of bid validity for complete package/Tender.

32.2 The Bidder having lesser Bid Security will be rejected as non-responsive and Acceptance of Bid be awarded to next bidder; being the responsive lowest bidder.

33. Procuring Agency's right to vary quantities at time of Award

33.1 The Procuring Agency reserves the right at the time of Contract award to increase the quantity of goods originally specified in the Price Schedule and Schedule of Requirements without any change in unit price or other terms and conditions.

36 Limitations on Negotiations

36.1 Save as otherwise provided there shall be no negotiations with the bidder having submitted the lowest evaluated bid or with any other bidder: provided that the extent of the negotiation permissible shall be subject to the regulations issued by the PPRA 2014 and its subsequent amendments, if any.

37. Notification of Award

37.1 Prior to the expiration of the period of bid validity, the Procuring Agency shall notify the successful Bidder in writing by registered letter that its bid has been accepted.

37.2 The notification of Award shall constitute the formation of the Contract.

38. Signing of Contract

38.1 At the same time as the Procuring Agency notifies the successful Bidder that its bid has been accepted, the Procuring Agency shall send the Bidder the Contract Form provided in the bidding documents, incorporating all agreements between the Parties.

38.2 Within ONE week of receipt of the Contract Form, both the successful Bidder and the Procuring Agency shall sign and date the Contract. The Procuring Agency shall issue Purchase Order on the same date of signing of Contract after ensuring the submission of Bank Security

for execution of the contract by the Contractor. If the successful Bidder, after completion of all codal formalities shows inability to sign the Contract then their Bid Security/ Contract Security to the extent of proportionate percentage shall be forfeited and the firm shall be blacklisted minimum for three years for future participation. In such situation the Procuring Agency may make the Award to the next lowest evaluated Bidder or call for re-bidding.

The contract is to be made on 04 stamp paper worth of Rs. @ 25 paisa per every one hundred rupees of the total value of the contract, under section 22(A)(B) of schedule 1 of Stamp Duty Act 1899 read with Finance Act 1995 (Act-VI of 1995) Notification No.JAW/HD/8-21/77 (PG) dated 1st January, 2014 and its subsequent amendments, if any.

39. Performance Guarantee

39.1 On the date of signing of the Contract, the successful Bidder shall furnish the Performance Guarantee/Security in accordance with the Special Conditions of Contract, in the Performance Guarantee/Security Form. The Performance Guarantee will be 5% of the contract amount. The performance security shall be deposited in the shape of Deposit at Call/ irrevocable Bank Guarantee in favour of **Faisalabad Institute of Cardiology – Security Account**.

39.2 Failure of the successful Bidder to comply with the requirement of ITB Clause 37 or ITB Clause 38.1 shall constitute sufficient grounds for the annulment of the Award, in which event the Procuring Agency may make the Award to the next lowest evaluated Bidder or call for re-bidding.

40. Schedule of Requirement

40.1 The supplies shall be delivered/ shipped within 90 days w.e.f the next date after the date of issue of Purchase Order (without penalty)/ opening of LC, and with prescribed penalty, as per following schedule of requirement:

Mode of penalty	Shipping/Delivery Period
Without Penalty	90 Days (Procuring agency may vary the delivery period according to the nature and volume of goods)

40.2 However, in special cases, delivery period can be fixed shorter or higher than the above mentioned schedule of requirement as deem appropriate by the Procuring Agency.

40.3 In case of late delivery of goods beyond the periods specified in the Schedule of Requirements, penalty @ 0.1% per day of the cost not exceeding 10% of the purchase order/contract value for late delivered supply shall be imposed upon the Supplier.

40.4 In case of DDP the delivery period will be started from the date of issuance of Purchase order to the Contractor and in the case of CIF it will be from the date of establishment of LC by the bank in favor of manufacturer/Beneficiary.

41. Redressal of grievances by the Procuring Agency

41.1 The Procuring Agency shall constitute a committee comprising of odd number of persons, with proper powers and authorizations, to address the complaints of bidders that may occur prior to the entry into force of the procurement contract.

41.2 Any bidder feeling aggrieved by any act of the Procuring Agency after the submission of his bid may lodge a written complaint concerning his grievances not later than fifteen days after the announcement of the bid evaluation report.

41.3 The committee shall investigate and decide upon the complaint within fifteen days of the receipt of the complaint.

41.4 Mere fact lodging of a complaint shall not warrant suspension of the procurement process.

41.5 Any bidder not satisfied with the decision of the committee of the Procuring Agency may lodge an appeal in the relevant court of jurisdiction.

B. General Conditions of Contract (GCC)

1. Definitions

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

- **a.** "The Contract" means the agreement entered into between the Procuring Agency and the Supplier, as recorded in the Contract Form signed by the Parties, including all attachments and appendices thereto and all documents incorporated by reference therein.
- **b.** "The Contract Price" means the price payable to the Supplier under the Contract for the full and proper performance of its contractual obligations.
- **c.** "The Goods" means medical equipment and machinery and other items which the Supplier is required to supply to the Procuring Agency under the Contract.
- **d.** "The Services" means those services ancillary to the supply of above goods, such as printing of special instructions on the label and packing, design and logo of the Institute/ Hospital, Insurance, transportation of goods up to the desired destinations, commissioning, training and other such obligations of the supplier covered under the Contract.
- **e.** "GCC" mean the General Conditions of Contract contained in this section.
- **f.** "SCC" means the Special Conditions of Contract.
- **g.** "The Procuring Agency" means the Medical Superintendent, Faisalabad Institute of Cardiology, Faisalabad advertised the tender.
- **h.** "The Procuring Agency's Country" is the country named in SCC
- **i.** "The Supplier" means the individual or firms or joint venture supplying the goods under this Contract.
- **j.** "Day" means calendar day.

2. Application

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

3. Country of Origin

3.1 Country of manufacturer should be of USA, Europe and Japan; unless otherwise any other country of manufacturer is mentioned in specifications. However, country of origin of equipment could be from any geographical region of the world as per laws of Pakistan

4. Standards

4.1 The medical equipment of USA must comply with 510(K) FDA (Food & Drug Administration), in case of Europe MDD (Medical Device Directive) and for Japan MHLW (Ministry of Health, Labour& Welfare) for specific quoted model. In case of high-tech equipment, any of the above mentioned two certificates are mandatory. The other/non medical equipment should complywiththerelevantNational/Internationalproductqualitystandardsofrespectiveorigins**.**

Use of Contract Documents and Information

5.1 The Supplier shall not, without the Procuring Agency's prior written consent, disclose the Contract, or any provision thereof, or any specification, plan, drawing, pattern, sample, or information furnished by or on behalf of the Procuring Agency in connection therewith, to any person other than a person employed by the Supplier 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 purposes of such performance.

5.2 The Supplier shall not, without the Procuring Agency's prior written consent, make use of any document or information enumerated in GCC Clause 5.1 except for purposes of performing the Contract.

5.3 Any document, other than the Contract itself, enumerated in GCC Clause 5.1 shall remain the property of the Procuring Agency and shall be returned (all copies) to the Procuring Agency on completion of the Supplier's performance under the Contract if so required by the Procuring Agency.

6. Patent Rights

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

7. Submission of Samples

7.1 The samples shall be submitted as per detail in ITB16.3.

8. Ensuring Storage/ Installation Arrangements

8.1 To ensure storage and installation arrangements for the intended supplies, the Supplier shall inform end user for pre-requisites well in time for proper installation. In case the Supplier abides by the given time frame he shall not be penalized for delay.

8.2 In case of late delivery of goods beyond the periods specified in the Schedule of Requirements, penalty @ 0.1% per day of the cost not exceeding 10% of the purchase order/contract value for late delivered supply shall be imposed upon the Supplier.

9. Inspections and Tests

9.1 The Procuring Agency or its representative shall have the right to inspect and/or to test the goods to confirm their conformity to the Contract specifications at no extra cost to the Procuring Agency.

9.2. For the purpose of inspections and tests of equipment. The Supplier shall furnish all reasonable facilities and assistance, to the inspectors at no charge to the Procuring Agency. In the event that inspection & testing is required prior to dispatch and categorically mentioned in the LC clauses, the goods shall not be supplied unless a satisfactory inspection report has been issued in respect of those Goods by the Procuring Agency. However, if the Supplier proves an undue delay in conduct of inspection on the part of Procuring Agency, the Supplier shall not be liable for penalty on account of that delay. The cost of such lab tests shall be borne by the Manufacturer/ Supplier.

9.3 The Procuring Agency's right to inspect, test and, where necessary, reject the goods after the goods have been installed at Procuring Agency's destinations.

9.4 The Procuring Agency's right to inspect the premises of bidders/ lead bidders/ firms of alliance to inspect their premises/ setups ensuring proper after sales services.

9.5 Nothing in GCC Clause 9 shall in any way release the Supplier from any warranty or other obligations under this Contract.

10. Physical Examination/ Inspection of Goods

10.1 The goods shall be acceptable subject to physical inspection, tests and/ or in accordance with the approved sample as decided by the Procuring Agency.

10.2 The Inspection Team will be designated by the Procuring Agency which will inspect each of the equipment/ goods as per contracted specifications and installation protocols recommended by the manufacturers.

11. Delivery and Documents

11.1 The Supplier in accordance with the terms specified in the Schedule of Requirements shall make delivery of the goods which is maximum 90-days from the date of issuance of this contract or opening/Establishment of LC. The details of original documents to be furnished by the Supplier are as follows;

- **a.** Operational Manuals of the medical equipment
- **b.** Service Manuals indicating step by step service/ maintenance protocols of each of the equipment.
- **c.** Periodic Preventive Maintenance schedules with recommended list of parts/ kits to be replaced during PPM.
- **d.** Any other requirement by the procuring agency.

12. Insurance

12.1 The goods supplied under the Contract shall be delivered duty paid (DDP) or CIF as mentioned under which risk is transferred to the buyer after having been delivered; hence, marine and inland insurance coverage is Supplier's responsibility. The Supplier shall ensure insurance in advance in full on prevailing premium rates at the time of shipment of the Goods on the behalf of the Purchaser for which the cost is inclusive in the Contract Price.

13. Transportation

13.1 The Supplier shall arrange such transportation of the goods as is required to prevent their damage or deterioration during transit to their final destination as indicated in the Schedule of Requirement.

13.2 Transportation including loading/ unloading of goods shall be arranged and paid for by the Supplier, and related cost shall be inclusive in the Contract price. The addresses of destinations/ offices shall be provided at the time signing of Contract.

14. Incidental Services

14.1 The Supplier shall be required to provide all the incidental service charges and the cost of such incidental services include in total Contract price.

14.2 The Procuring Agency will not pay any extra amount against any expenditure incurred on it, as the Contract shall be construed as fixed amount Contract and includes all costs.

14.3 The Procuring Agency will provide all the necessary documentations for facilitation but no amount to be given in any case except the Contracted amount.

14.4 All Custom Duties, if any, Octroi, Clearing Charges, transportation etc will be borne by the Contracting firm. However, Procuring Agency will provide all necessary documents for facilitation but no amount to be given in any case except the Contracted amount.

15. Warranty

15.1 A comprehensive warranty of one (01) year for complete system will be provided free of cost including parts, labour, unless otherwise separately mentioned in the specifications. The procuring agency may increase or decrease the span of warranty period as per their institutional requirement. The supplier will categorically mention the disposable/consumable items of the equipment good in advance along with the submitted tender, any item declaration as consumable /disposable after the submission of bid/quotation will not submitted.

16. Payment

16.1 The method and conditions of payment to be made to the Supplier under this Contract shall be specified in SCC.

16.2 In case of imported goods to be procured on CIF basis; the payment will be made 100% via establishing the LC in favor of manufacturer at sight and receiving the shipping documents/ Bill of lading, Insurance, Inspection certificate of the manufacturer, Country of origin, compliance of International standards of quality as per INCOTERMS of latest version Contract. The procuring agency may define its own financial values for the establishment of LC, in case of any special

requirement.

16.3 In case of DDP; the payment will be made 100% after presentation of the delivery/ Installation/commissioning/completion/execution report of the contract and all other works described in Contract. Unless otherwise part payment, part delivery mentioned in the specifications.

17. Prices

17.1 Prices charged by the Supplier for goods delivered under the Contract shall not vary from the prices quoted by the Supplier in its bid and shall remain the same till expiry of the original bid validity period provided the Procuring Agency's request for bid validity extension.

18. Contract Amendments

18.1 No variation in or modification of the terms of the Contract shall be made.

18.2 No variation in finalized brands/ makes/models shall be allowed except in special conditions where the manufacturer has stopped producing or suspended that model or the latest model of similar series or version has been launched by the manufacturer or non-availability due to international mergers of the manufacturers or similar unavoidable constraints.

19. Assignment

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

20. Subcontracts

20.1 The Supplier shall not be allowed to sublet the job and award subcontracts under this Contract except the firms involved in the Joint Venture/Consortium.

21. Delays in the Supplier's Performance

21.1 Delivery of the goods shall be made by the Supplier in accordance with the time schedule prescribed by the Procuring Agency in the Schedule of Requirements.

21.2 If at any time during performance of the Contract, the Supplier should encounter conditions impeding timely delivery of the goods, the Supplier shall promptly notify the Procuring Agency in writing of the fact of the delay, its likely duration and its cause(s). As soon as practicable after receipt of the Supplier's notice, the Procuring Agency shall evaluate the situation and may at its discretion extend the Supplier's time for performance, with or without liquidated damages, in which case the extension shall be ratified by the Parties by amendment of Contract.

21.3 Except as provided under GCC Clause 8.2, a delay by the Supplier in the performance of its delivery obligations shall render the Supplier liable to the imposition of liquidated damages pursuanttoGCCClause22,unless an extension of time is agreed upon pursuant to GCC Clause 21.2 without the application of liquidated damages.

22. Penalties/Liquidated Damages

22.1 In case of late delivery beyond the presented period, penalty as specified in SCC shall be imposed upon the Supplier / Manufacturer. The above Late Delivery (LD) is subject to GCC Clause 24, including late delivery for reasons beyond control. Once the maximum is reached, the Procuring Agency may consider termination of the Contract pursuant to GCC Clause 23.

22.2 If the firm provide substandard item and fail to provide the item the payment of risk purchase(which will be purchased by the indenter)the price difference shall be paid by the Firm.

23. Termination for Default

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

- **a.** if the Supplier fails to deliver any or all installments of the goods within the period(s) specified in the Contract, or within any extension thereof granted by the Procuring Agency pursuant to GCC Clause 8.2; or
- **b.** if the Supplier fails to perform any other obligation(s) under the Contract.
- **c.** if the Supplier, in the judgment of the Procuring Agency has engaged in corrupt or fraudulent practices in competing for or in executing the Contract. For the purpose of this clause: **"corrupt practice"** means the offering, giving, receiving or soliciting of

any thing of value to influence the action of a public official in the procurement process or in Contract execution.

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

24. Force Majeure

24.1 Notwithstanding the provisions of GCC Clauses 21, 22, and 23, the Supplier shall not be liable for forfeiture of its Performance Guaranty/ bid Security, or termination/ blacklisting for default if and to the extent that its delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure. For the purposes of this clause Force Majeure means an act of God or an event beyond the control of the Supplier and not involving the Supplier's fault or negligence directly or indirectly purporting to mis-planning, mismanagement and/or lack of foresight to handle the situation. Such events may include but are not restricted to acts of the Procuring Agency in its sovereign capacity, wars or revolutions, fires, floods, earthquakes, strikes, epidemics, quarantine restrictions and freight embargoes. If a Force Majeure situation arises, the Supplier shall promptly notify the Procuring Agency in writing with sufficient and valid evidence of such condition and the cause thereof. The Committee of Ministry of Health, constituted for Redressal of grievances, shall examine the pros and cons of the case and all reasonable alternative means for completion of purchase order under the Contract and shall submit its recommendations to the competent authority. However, unless otherwise directed by the Procuring Agency in writing, the Supplier shall continue to perform its obligations under the Contract as far as is reasonably practical and shall seek reasonable alternative means for performance not prevented by the Force Majeure event.

25. Termination for Insolvency

25.1 The Procuring Agency may at any time terminate the Contract by giving written notice of one month time to the Supplier if the Supplier becomes bankrupt or otherwise insolvent. In this event, termination shall be without compensation to the Supplier, provided that such termination shall not prejudice or affect any right of action or remedy which has accrued or shall accrue thereafter to the Parties.

26. Arbitration and Resolution of Disputes

26.1 The Procuring Agency and the Supplier 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.

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

26.3 In case of any dispute concerning the interpretation and/or application of this Contract shall be settled through arbitration. The arbitrator will be appointed with mutual consent of both the parties. The decisions of the Arbitrator shall be final and binding on the Parties.

27. Governing Language

27.1 The Contract shall be written in English language. Subject to GCC Clause 28, the version of the Contract written in the specified language shall govern its interpretation. All correspondence and other documents pertaining to the Contract, which are exchanged by the Parties, shall be written in English.

28. Applicable Law

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

29. Notices

29.1 Any Notice given by one party to the other pursuant to this Contract shall be sent to the other party in writing and confirmed to other party's address specified in SCC.

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

Special Conditions of Contract (SCC)

Special Conditions of Contract shall be concluded between the Procuring Agency and the successful bidder(s) as per specific requirement of the specific Product. In case where there is a conflict between the general conditions of the contract and the special conditions of contract, the special condition of contract shall prevail.

1. General:

1.1 The imported goods shall be of USA, European or Japanese Origin firms; unless otherwise any other country of manufacturer is mentioned in specifications however their delivery/ provision may vary according to geographical location of their factories.

1.2 The fee of all necessary licenses required to install and operate the equipment shall be born by the Supplier and Procuring agency will facilitate through documents only.

1.3 The Bank Guarantee will be discharged after successful installation, commissioning, servicing and completion of warranty period (or for any other period mentioned in the specifications). A clearance letter/NOC will be issued by the head of concerned institution.

1.4 The Supplier shall be deemed to have obtained all the information regarding facilities and charges, in respect of port clearance, loading and unloading, storage, transportation, congestion, Octri, licensing fee and confirmed the requirements thereof at his own responsibility and all such costs and charges are deemed to be included in the rates and prices mentioned in the Priced BOQ and the Procuring Agency will not pay any amount over this contracted amount whether in case of CIF or free delivery consignments.

1.5 Certificate from the manufacturer that they will provide after sales services through its agent and in case of change of its agent, it will provide the services itself or newly appointed Sole agent/ Sole distributor.

1.6 The Supplier shall arrange the necessary arrangements for training of hospital staff including doctors, technician, paramedical staff and biomedical engineers. The supplier shall provide a factory training of quoted medical equipment to the hospital biomedical engineer and clinical training to the doctors, if specifically demanded in the advertised specifications/tender.

1.7 For smooth functioning and management of medical and other equipment, it is mandatory for the bidders to provide sufficient technical training for high-tech equipment for the biomedical engineers and allied staff from factory trained experienced engineers at the concerned institute.

2. Insurance of Local Goods

2.1 Insurance of Local Goods and other materials from factory to Site shall include all insurance costs covering the responsibility of all losses or damages, while loading, unloading, storing, trimming on the carrier and transporting to Site up to the installation, testing & commissioning of the medical equipment.

2.2 Checking and verifying of consignments, issuance of receiving reports and damage

reports (when applicable) shall be the Contractor's responsibility.

2.3 The cost of insurance shall be quoted on the basis of insurance through National Insurance Company (NIC) of Pakistan or any other insurance company operating in Pakistan acceptable to the Procuring Agency.

3. Payment

3.1 In case of imported goods; the payment will be made 100% via establishing the LC in favor of manufacturer/beneficiary at sight and receiving shipping documents/ Bill of lading, Insurance, Inspection certificate of the manufacturer, Country of origin, compliance of International standards of quality as per INCOTERMS of latest version. The payment will be made in the following manner through a letter of credit to be opened by the Procuring Agency. The procuring agency may define its own financial values for the establishment of LC, in case of any special requirement

3.2 The amount of Letter of Credit shall be paid to beneficiary/Manufacturer on production of the following non-negotiable documents.

i. Draft.
ii. Three original and two copies of the Supplier's Invoice showing purchaser as Medical Superintendent, Faisalabad Institute of Cardiology, Faisalabad, the Contract No., Goods description, quantity, unit price and total amount. Invoice must be signed in original stamped or sealed with company stamp or seal.
iii. **Four** Copies of packing list identifying content of each package.
iv. One original and two copies of the negotiable, clean, on board through bill of lading marked "freight prepaid" and showing purchaser as Medical Superintendent, Faisalabad Institute of Cardiology, Faisalabad.
v. Copy of insurance certificate showing purchaser as the beneficiary;
vi. Theoriginalofthemanufacturer'swarrantycertificatecoveringallitemssupplied;
vii. OneoriginalcopyoftheSupplier'sCertificateoforigincoveringallitemssupplied.
viii. Original copy of the certificate of Pre-Shipment inspection furnished to Supplier by the purchaser representative (if specifically required by the purchaser).
ix. Test/ Inspection Certificate of manufacturers.
x. Compliance Report of Internal Quality Standards.
xi. Product model, serial numbers.
xii. Manufacturer's Guarantee Certificate to the effect that:
    a) the goods supplied by them are strictly in conformity with the specifications stipulated in the contract.
    b) the goods have been packed and marked suitable for transport by Sea, Rail, Road and Air in terms of the contract.
    c) the stores supplied by them are brand new and absolutely free from any material or manufacturing defects.
    d) Manufacturer's test certificate in respect of each consignment.

3.3 In case of DDP; the payment will be made 100% after presentation of the delivery/ Installation/commissioning/completion report of the equipment and all other works described in Contract. Unless otherwise part payment, part delivery mentioned in the specifications.

4. Execution of Warranty

4.1 A Log Book for the medical equipment which needs regular after sales services (To be specified by the procuring agency in bidding document) shall be maintained by the Supplier Service Engineer in consultation with the end user department. This will include the name of the equipment, down time, preventive maintenance schedule, replacement of parts ,down time etc.

4.2 The Warranty will start from the date of acceptance of equipment (properly installed, as per contracted specifications and handing over of related documents mentioned in GCC and will last for its warranty period at 95%uptime.

4.3 The maintenance will be the responsibility of the manufacturer / their agent. An annual

optimal uptime of 95% is considered as acceptable level of performance.

4.4 Software and hardware up gradation of the computing system should be carried out as available during warranty period as recommended by the manufacturer. Manufacturer / Supplier shall be responsible for rectifying with all possible speed at their own expense any defect or fault in the system which may develop at any time during installation, commissioning period.

4.5 Manufacturer will guarantee the availability of spare parts and accessories for the system for ten years.

4.6 Uptime shall be defined as the time available to the user for doing procedures/ data acquisition and processing during working hours throughout the year.

4.7 Manufacturer /Supplier shall check system performance during and after every 4-months. An "Optimal Percentage" will be calculated by dividing "System in Service" hours by hours available, both measured on the basis of working hours as detailed above.

4.8 If the uptime percentage for the measurement period (04-months) shall fall short of 95% the following formula will be applied to determine additional days in the warranty / service contract period.

a.	100% -95%	No Penalty
b.	95% -90%	The warranty period will be extended by 2.0 times the number of days as extra downtime.
c.	90% -80%	The warranty period will be extended by 3.0 times the number of days as extra downtime
d.	Below 80%	The warranty period will be extended by 4.0 times the number of days as extra downtime

4.9 Down time is defined as the failure in the equipment operation to acquire or process the data or procedure, resulting in inability to carry out the required procedure properly.

4.10 The firm will be bound to make arrangements for availability of qualified technical staff in hospital / site for prompt execution/coordination of after sale services.

4.11 Down time will start when the end user/ Staff In-charge notifies the designated service facility verbally or in writing to qualified technical staff of the firm stationed in the Hospital.

4.12 Down time will end once the repairs have been affected and the system is again available for clinical use.

4.13 The firm will provide the recommended preventive maintenance schedule of each of the equipment at the time of delivery.

4.14 The firm will bound to execute the installation/ maintenance according to the installation/ service protocol and will replace the components/ kits recommended by the manufacturers for installation and Periodic Preventive maintenance.

4.15 The scheduled preventive maintenance shall be in accordance with Service Protocol recommended/ advised by the manufacturer.

4.16 Remote service via modem shall be preferred if provided by the manufacturer to pick-up early faults at no cost to the hospital for the high-tech equipment.

4.17 The manufacturer / supplier will be responsible for preventive maintenance of equipment as per manufacturers 'Service Manuals and shall keep a check for electrical /magnetic / temperature and humidity conditions. Such a check should be made monthly and record should be maintained in the log book of the hospital.

5. Packing &Marking

5.1 Packing: Usual export packing to ensure safe journey up to the site of consignee.

Marking: Each packing should be clearly marked in suitable size in bold letters as per requirement.

6. Trans-shipment

6.1 Trans-shipment is not allowed (In case of no direct flight from the shipping country to the destination, this may be reviewed by the procuring agency on case to case basis).

7. Place of delivery

7.1 As per detail mentioned in the invitation for bids/tender notice.

8. Correspondence addresses

Procuring Agency

Medical Superintendent, Faisalabad Institute of Cardiology, Faisalabad.

Contracting Firm

M/S----------

(Sample)

INVITATION FOR BIDS

Government of Punjab, Health Department invites sealed bids from the firms having established credentials in terms of Technical, Financial and Managerial capabilities for the supply of medical equipments as per details given below during current financial year 2014-15:

Tender/ Package#	Detail of Equipments	Quantity
1	Name of equipment	01

2. Interested bidders may get the bidding document along with detailed specifications from the office of **Purchase cell of Faisalabad Institute of Cardiology, Faisalabad** on submission of written application on letter head and a copy of CNIC along with payment of non-refundable fee of Rs.1,000/- (One thousand only) for each item/package. The bidding document can also be downloaded from the website www.ppra.punjab.gov.pk. Detailed specifications shall be issued as per advertisement given in PPRA and Health Department Website.

3. 02% Bid Security shall be attached with the bid in the shape of Irrevocable Bank Guarantee or CDR from any scheduled bank otherwise tender will be rejected.

4. Single Stage – Two Envelopes bidding procedure shall be applied. The envelopes shall be marked as "FINANCIAL PROPOSAL" AND TECHNICAL PROPOSAL" in bold and legible letters. Financial proposal of bids found technically non-responsive shall be returned un-opened to the respective bidders.

5. Procurements shall be governed under the Punjab Procurement Rules,2014.

6. Sealed bids are required to be brought in person by the authorized representative of the interested bidders as per dates given on the advertisement published in PPRA and Health Department website.Thebidsreceivedtillthestipulateddate&timeshallbeopenedonthesamedayat11.30 A.M. in the presence of the bidders or their authorized representatives by the purchase committee.

7. in case of tender as package. The bidders are required to quote for complete package(s). The bidders may participate individually or in association with other qualified agents to complete items of the package(s).

8. All bids should be submitted in tape or ring binding. Bids with loose papers shall be rejected straightaway. All documents should contain proper page marking, attached in sequence as indicated for evaluation in the bidding document and signatures of authorized person. Moreover, signing and stamping of each page of bidding document/form is mandatory otherwise bid shall be rejected straightaway.

9. Pre-bid meeting shall be held on **as per dates given on the advertisement published on PPRA**

website and advertisement in the Conference room Faisalabad Institute of Cardiology, Faisalabad. All interested bidders are requested to submit their reservations, if any, in writing by which will be discussed in the meeting for appropriate decision.

10. In case the date of opening or last date of sale of tender documents is declared as a public holiday by the government or non-working day due to any reason, the next official working day shall be deemed to be the date of sale, submission and opening of tenders accordingly. The time and venue shall remain the same.

Performance Guarantee Form

To: *[Name & Address of the* Procuring Agency*]*

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

And whereas it has been stipulated by you in the said Contract that the Supplier shall furnish you with a Bank Guarantee by a scheduled bank for the sum of 5% of the total Contract amount as a 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_____,201

Signature and Seal of the Guarantors/Bank

Address

Date

Note: 1. It should be valid for a period equal to the warranty period.

2. The contract will be signed/ issued after submission of this Performance Security.
3. The firm may submit the Performance Security for the Complete Package by the Lead Contractor or individually for the respective portions of the firms in case of alliance.

Contract Form

(On stamp paper worth Rs. @ 25 paisa per every one hundred rupees of the total value of the contract)

THIS CONTRACT is made at on day of 2022, between the (hereinafter referred to as the "Procuring Agency") of the First Part; and M/s *(firm name)* a firm having its registered office at *(address of the firm)* (hereinafter called the "Supplier") of the Second Part (hereinafter referred to individually as "Party" and collectively as the "Parties").

WHEREAS the Procuring Agency invited bids for procurement of goods, in pursuance where of M/s *(firm name)* being the Manufacturer/ authorized Supplier/ authorized Agent of (item name) in Pakistan and ancillary services offered to supply the required item (s); and Whereas the Procuring Agency has accepted the bid by the Supplier for the supply of *(item name)* and services in the sum of Rs*(amount in figures and words)* cost per unit, the total amount of *(quantity of goods)* shall be Rs*(amount in figures and words) for free delivery items and/or unit price €/£/$/¥/CHF\_\_\_\_\_for the total price\_\_\_\_\_€/£/$/¥/CHF of the items of CIF portion for establishing the LC.*

NOW THIS CONTRACT WITNESSETH AS FOLLOWS:

1. In this Contract words and expressions shall have the same meanings as are respectively assigned to them in the General Conditions of this Contract hereinafter referred to as "Contract":
2. The following documents shall be deemed to form and be read and construed as integral part of this Contract ,viz:-
    - **a.** the Price Schedule submitted by the Bidder,
    - **b.** the Schedule of Requirements;
    - **c.** the Technical Specifications;
    - **d.** the General Conditions of Contract;
    - **e.** the Special Conditions of Contract;
    - **f.** the Procuring Agency's Notification of Award;
    - **g.** the scope of work;
    - **h.** the Contract; and
    - **i.** the Bid & its clarifications.
    - **j.** the contracted specifications (attached as annexure)
    - **k.** any undertaking provided by the firm
3. In consideration of the payments to be made by the Procuring Agency to the Supplier/ Manufacturer as hereinafter mentioned, the Supplier/ Manufacturer hereby covenants with the Procuring Agency to provide the Goods and Services and to remedy defects therein in conformity in all respects with the provisions of this Contract.
4. The Procuring Agency hereby covenants to pay the Supplier in consideration of the provision of the Goods and Services and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of this Contract at the time and in the manner prescribed by this Contract.
5. *[The Supplier]* hereby declares that it has not obtained or induced the procurement of any Contract, right, interest, privilege or other obligation or benefit form Government of the Punjab or any administrative subdivision or

agency thereof or any other entity owned or controlled by it (Government of the Punjab) through any corrupt business practice.

6. Without limiting the generality of the foregoing, [the Seller/ 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 including the procurement of a Contract, right interest, privilege or other obligation or benefit in whatsoever form from Government of the Punjab, except that which has been expressly declared pursuanthere to.
7. *[The Supplier]* certifies that has made and shall make full disclosure of all agreements and arrangements with all persons in respect of or related to the transaction with Government of the Punjab and has not taken any action or shall not take any action to circumvent the above declaration, representation or warranty.
8. *[The 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 right and remedies available to Government of the Punjab under any law, Contract or other instrument, be void able at the option of Government of the Punjab.
9. Notwithstanding any rights and remedies exercised by Government of the Punjab in this regard, *[The Supplier]* agrees to indemnify Government of the Punjab for any loss or damage incurred by it on account of its corrupt business practices and further pay compensation to Government of the Punjab in an amount equivalent to ten time the sum of any commission, gratification, bribe, finder's fee or kickback given by *[The Seller/ 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 Government of the Punjab.
10. In case of any dispute concerning the interpretation and/or application of this Contract shall be settled through arbitration. The decisions taken and/or award made by the arbitrator shall be final and binding on the Parties.
11. This Contract shall be governed by the laws of Pakistan and the courts of Pakistan shall have exclusive jurisdiction.

IN WITNESS Whereof the Parties hereto have caused this Contract to be executed at_____(the place) and shall enter into force on the day, month and year first above mentioned.

Signed/ Sealed by the Manufacturer/ authorized Supplier/authorized Agent	Signed/ Sealed by Procuring Agency
1.	**1.**
2.	**2.**

<u>Note</u>: 1. In case of alliance; all the firms have to sign this document jointly along with Procuring Agency, as all firms will bear equal responsibility in execution of the contract.

Bid Form

Date:
Tender No:
Name of the Item:

To: [Name and address of Procuring Agency]

Respected Sir

Having examined the Bidding Documents, the receipt of which is hereby duly acknowledged, we, the undersigned, offer the supply and deliver the goods specified in and in conformity with the said Bidding Documents for the sum of *[Total Bid Amount]*, *[Bid Amount in words]* 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 shall obtain an unconditional guarantee of a bank in the sum of 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 ITB Clause 18 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.

We understand that you are not bound to accept the lowest or any bid you may receive. 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 bidder
(if none, state“none”).”

Amount and Currency

Dated this day of ,201-

Signature
(in the capacity of)

Duly authorized to sign bid for and on behalf of

Attachment

Price Schedule

(CIF Tender)

Name of Bidder_____

Tender No. and the name of the package/Tender----------

Item. No.	Name of Item (As listed in invitation of bid)	Make	Model	Country of Origin	Country of Manufacturer	Supplier	Name of Port of dispatch	Qty	Unit CIF Price (€/£/$/¥/*CHF*)	Total Price for each item (€/£/$/¥/*CHF*)	Name of beneficiary bank
		Total Package Cost after conversion (Rs.)									

Sign and Stamp of Bidder_____

Note: 1. In case of discrepancy between unit price and total, the unit price shall prevail.

2. Foreign currency rate will be considered on the date of opening of Financial Bid as per selling rate announced by the National/ State Bank.

Price Schedule

(DDP Tender)

Name of Bidder_____

Tender No. and the name of the package/Tender ----------

Item. No.	Name of Item (As listed in invitation of bid)	Make	Model	Country of Origin	Country of Manufacturer	Supplier	Qty	Unit Price (Rs)	Total Price for each item (Rs)
Total Package Cost (Rs.)									

Sign and Stamp of Bidder_____

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

(TEMPLATE)

BID EVALUATION SHEET

Package no/Tender Number:----------
Name of the Equipment and Qty:----------

PART- I
KNOCK DOWN CRITERIA - (COMMERCIAL EVALUATION)
(To be evaluated by Purchase Department)
(All evaluation parameters defined below are mandatory for compliance)

Sr. No.	Evaluation Parameters	M/S ABC	M/S XYZ
1	**Complete Package/Tender**	Yes / No	Yes / No
2	**Original Receipt of Tender**	Yes / No	Yes / No
3	**Affidavit from Bidder**	Yes / No	Yes / No
4	**Bid Validity**	Yes / No	Yes / No
5	**Delivery Period**	Yes / No	Yes / No
6	**Prequalification Status**	Yes / No	Yes / No
	Remarks:	(Eligible/Not Eligible for further evaluations of PART-II)	(Eligible/ Not Eligible for further evaluations of PART-II)

PART- II
KNOCK DOWN CRITERIA - (VENDOR EVALUATION)
(To be evaluated by Technical Evaluation Committee)
(All evaluation parameters defined below are mandatory for compliance.)

Sr. No.	Evaluation Parameters	M/S ABC	M/S XYZ
1	**Compliance of Warranty as per tender**	Yes / No	Yes / No
	Remarks:	(Eligible/ Not Eligible for further evaluations of PART-III)	(Eligible/ Not Eligible for further evaluations of PART-III)

PART – III
KNOCK DOWN CRITERIA - PRODUCT EVALUATION
(All evaluation parameters defined below are mandatory for compliance.)

Item Sr.No	SPECIFICATION COMPLIANCE /EVALUATION PARAMETERS			
1	Name of Equipment	Brand		
		Model		
Country of Manufacturer				
Country of Origin of Product/Model Number				
Compliance with defined quality standards				
Specification Compliance features wise:			**Remarks**	**Remarks**
Specifications:			Technically Acceptable /Not (Mention the reasons)	Technically Acceptable/Not (Mention the reasons)
Technical Eligibility of Product:			Eligible / Not Eligible	Eligible / Not Eligible
Technical Eligibility of Firm:			Eligible / Not Eligible	Eligible / Not Eligible
BID STATUS:			**Responsive/Substantially Responsive/Non Responsive**	**Responsive/Substantially Responsive / Non Responsive**

Note:

1. Non compliance of any of above evaluation parts will lead to the rejection of bid straightway.
2. Detail of rejection of any bid will be mentioned in detail.
3. The Technical status of offers will be declared as Responsive, Non Responsive and Substantially Responsive.
4. The offer will be considered as responsive if it fully meets the tender requirement and specifications.
5. The offer which will not be as per requirement of tender and specifications is to be declared as nonresponsive.
6. The bid with minor deviations without any effect on the quality, efficiency, reliability and durability of products will be declared as substantially responsive. The minor deviations will be determined by the Technical Evaluation Committee.

7. The bids declared either as Responsive or Substantial Responsive will be considered as acceptable bid for further processing.
8. Sample, where required by the procuring agency will be evaluated by the Technical Evaluation Committee by analyzing its Production quality, Design, Reliability, Conformance to the specification and safe for the usage etc. This report will become the part of above Performa as sample evaluation report.
9. In case of requirement, Procuring Agency / Technical Evaluation committee may inspect the premises of bidder to inspect the Technical and Managerial Capability/ setups for ensuring proper after sales services.

Note: Specifications and drawings can be obtained from purchase cell F.I.C, Faisalabad / F.I.C website www.fic.gop.pk => Tender updates

FAISALABAD INSTITUTE OF CARDIOLOGY,
FAISALABAD

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF NEW CHILLER, COOLING TOWER AND AIR HANDLING UNITS AT FAISALABAD INSTITUTE OF CARDIOLOGY, FAISALABAD

BIDDING DOCUMENTS

VOLUME II

- Special Provisions
- Technical Provisions
- Equipment Schedule
- Schedule of Prices

December 2021

National Engineering Services Pakistan (Pvt) Limited
Building Services Division
IEEEP Building, 17-C-1, Civic Center, Faisal Town, Lahore 54700 – Pakistan
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SPECIAL PROVISIONS

TABLE OF CONTENTS

SPECIAL PROVISIONS

TABLE OF CONTENTS

TECHNICAL PROVISIONS FOR HVAC WORKS

TABLE OF CONTENTS

TECHNICAL PROVISIONS FOR HVAC WORKS

TABLE OF CONTENTS

TABLE OF CONTENTS

TECHNICAL PROVISIONS FOR HVAC WORKS

TABLE OF CONTENTS

SPECIAL PROVISIONS

SPECIAL PROVISIONS

SP-01 GENERAL

SP-01.1 Location of Project

The new equipment shall be installed at existing Plant Room of Faisalabad Institute of Cardiology, Faisalabad.

SP-01.2 Building for the Project

The building is an already constructed building and the Contractor shall be responsible to coordinate with existing work with respect to provisions of space, openings in walls, floors, roof slabs, drain points and electrical requirements for HVAC Works. All relevant civil work mentioned in Bidding Documents is in scope of contractor.

SP-01.3 Use of Building

The building is cardiology hospital. The building comprises of laboratories, consultant rooms, doctor's offices, operation theatres, wards, private rooms, waiting halls, nursing stations, isolation rooms, intensive care units (ICU) and stores.

SP-01.4 HVAC System Concept

a) Type of System:

Building is served with the Central HVAC System having Dual Fuel Direct Fired Double Effect Absorption Chiller-Heater, Cooling Towers, Pumps and Air Handling Units (AHUs). In this Contract, new one (01) Dual Fuel Direct Fired Double Effect Absorption Chiller-Heater, new one (01) Cooling Towers and new two (02) Air Handling Units (AHUs) are to be replaced with existing equipment.

b) Plant Operation during Power Failures

As the cooling/heating will be required continuously during power break down or load shedding so all HVAC equipment shall be connected to emergency power.

SP-01.5 Service Conditions for Auxiliaries

a) Power Supply

Electrical Circuit Voltages:
Nominal, 3-Phase: 415 volts
1-Phase: 240 volts
For equipment ratings, 3-Package: 400 volts
1-Package: 230 volts

Fluctuation in voltage applied (+/-) 10% to equipment rated voltage. Frequency: 50 HZ.

b) Water Supply will be available in central plant room (CPR)

c) Water Disposal:

Floor drains shall be connected to sewerage system of the building.

SP-01.6 Units

The units used in these specifications are as under:

Unit System: SI/British/FPS

Gauge: US Gauges as per ASTM

TR: Tons of Refrigeration equivalent to 12000 BTU/H (12 MBH) or 3516 W

SP-02 WORK BY THE CONTRACTOR

SP-02.1 Scope of Work

a) The work under this Contract comprises of supply, replacement, installation, balancing, testing & commissioning of brand new One (01) Dual Fuel Direct Fired Double Effect Chiller-Heater, One (01) Cooling Towers and Two (02) Air Handling Units (AHUs) and any other Associated works.

b) The work under this Contract also includes the dismantling and safe handling and storage of existing HVAC system components. Contractor is responsible for maintaining all Health and Safety standards at site. The Contractor is responsible to arrange all the safe guarding and firefighting equipment required for safety precautions.

c) The Contractor shall furnish all labor, materials, equipment tools, appurtenances, services, temporary work and storage necessary to completely supply, install, test, commission, and operate & maintain the heating, ventilating and air-conditioning (HVAC) system, all in the perfect operating conditions in accordance with these Specifications and Drawings. The Contractor shall also test, adjust, balance, re-adjust all the water systems as specified and shown. The Contractor shall commission and maintain all the systems for a period specified in Clause SP-20 under Defect Liability Period.

d) The complete civil work as mentioned in schedule of price and any

relevant civil work required to complete the job is included in Contractor's scope of work.

e) The Contractor shall plan and coordinate his activities and schedules so as not to interfere with the work of other. Also, interference with other building associated work shall be totally avoided and contractor shall prepare the schedule of work accordingly. It shall also be his responsibility to maintain the facility constructed by him till the end of the Contract period.

Any problem of interface with ongoing hospital activities shall be brought to the notice of the Engineer/Employer whose decision in this respect shall be final and binding on all parts.

The contractor shall inform for the schedule of any construction activity well in advance to meet the operational requirement of the hospital.

If any part of the work is damaged or has to dismantle or redone due to negligence/omission/incorrect position of the embedment etc. as part of the contractor, all such loses/expenses shall be borne by the Contractor.

f) The Specifications are only general guidelines and by no means cover details of each 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 with the Bid. The specifications are to be read in conjunction with the Drawings.

All equipment and materials shall be brand new bearing stamped ratings as required by Equipment Schedules and must be approved by the Engineer prior to their use. Any doubts about the practicability and implementation of Specifications and details shown in the Drawings must be expressed along with submission of Bid. Inability of the Contractor to implement these specifications after the acceptance of the Contract shall be considered breach of Contract.

SP-02.2 Services by the Contractor

a) Erection Supervisor

The Contractor shall provide competent Erection Supervisor to direct and be responsible for the erection, starting and operation of the Equipment supplied by the Contractor until issuance of Substantial Completion Certificate. Further details concerning Erection Supervisors are covered in Clause SP-17, "Erection Supervisors and Operating Staff". In addition, the Contractor shall also provide services of Factory Engineer authorized by

manufacturer to direct and supervise the installation, testing & commissioning.

b) Operation during Defect Liability Period.

The Contractor shall maintain HVAC system for a period mentioned in and as per requirements of Clause SP-20, “Defect Liability Period”. The Contractor shall provide all personnel for maintenance including one Supervisor. Qualifications, experience and number of all these personnel shall be subject to the Engineer's approval.

c) Training of Employer’s Operative Personnel.

The Contractor shall arrange for free of cost on-site training of operative personnel, nominated by the Employer, in the operations and maintenance of all HVAC equipment and system. The period of training shall not be less than fifteen (15) days.

The group of operative personnel will comprise of Engineers/ Supervisors and Technicians. The training shall be delivered by a qualified Engineer having at least ten (10) years’ experience in the operation and maintenance of similar HVAC systems.

The Trainer shall fully orient the group with the actual system and impart thorough training in the operations and maintenance of the system and equipment with the help of drawings, charts, hand-outs, diagrams, video aids, lectures, etc. Details and time of training shall be approved by the Employer/Engineer before training is commenced.

SP-02.3 Erection Plant

Under this clause the Contractor shall provide erection plant and tools for his own use during erection period only; he would take back these tools on completion.

The Contractor shall furnish special erection plant and tools in accordance with the requirements of Clause SP-14, "Fabrication, Erection Testing and Maintenance Tools Plant and Instruments.

SP-02.4 Related Works

The Contractor shall provide all works related to HVAC system, whether specifically mentioned or not. These related works shall include, but not be limited to:

a) Power supply and earthing shall be provided by the Employer and incoming power feeders and earth continuity conductors shall be terminated at locations available at site.

b) Water supply shall be provided by others from overhead tank in the central plant room and near cooling tower. Connection with Plumbing works from the points at site to make-up water point shall be the responsibility of the Contractor.

c) All works related to water and cooling coil condensate disposal from HVAC system up to nearest floor drains shall be the responsibility of the Contractor.

d) Cutting, patching and repairing in accordance with Section 1.0 of the Technical Provisions.

e) All wood-work required for satisfactory completion of the project as specified except decorative wood work provided to conceal HVAC equipment.

f) Providing shop drawings at scale (1:50) and other written information regarding Concrete Pads and foundations for HVAC equipment to the Civil Contractor through the Engineer. Catalogue cuts showing foundation details will not be accepted.

g) Providing steel frames for inertia pads and cork sheet/neoprene sheet for other pad.

h) All foundations for HVAC equipment including concrete foundations, housekeeping pads and concreting for inertia pads (where required) shall be provided by the HVAC Contractor.

i) Coordinating HVAC installation with other trades work, by way of study of other trades drawings and pointing out the areas of conflict to the Engineer before installing items of HVAC system.

SP-03 DESIGN CONDITIONS

HVAC System has been designed with conditions listed hereunder.

SP-03.1 Outside Design Conditions

The equipment shall be capable of working at following temperature;

a) Summer dry Bulb Temp: (Max.) 48 °C

b) Winter Dry Bulb Temp: 1 °C

c) Wind Velocity:

- Summer 16 KPH
- Winter 24 KPH

d) Climate: Tropical with dust storms in April-May-June and torrential Rains in July - August - September.

i)	Latitude:	34 Degrees North
ii)	Longitude	72 Degrees East
iii)	Elevation	702 m

SP-03.2 Inside Design Conditions (N/A)

SP-04 DRAWINGS, EQUIPMENT SUBMITTALS, INFORMATION MANUALS, SAMPLES & CONTRACTOR'S OTHER SUBMISSIONS

SP-04.1 General

All drawings, other information and samples must be supplied to the Engineer as laid down in these Specifications and as and when agreed during site meetings, in the Progress Chart or as instructed by the Engineer.

The Contractor shall submit, for approval, detailed submittals as specified and no material or equipment may be delivered to the job site or installed until the Contractor has in his possession with the approved Data Sheet, Catalogue cuts or samples of particular material. Approval rendered on submittals shall not be considered as a guarantee of measurements or building conditions.

Where submittals are approved, said approval does not in any way relieve the Contractor from his responsibility for necessity of furnishing material or performing work as required by the Drawings and Specifications.

Failure of the Contractor in providing submittals in ample time for checking shall not entitle him to an extension of the Contract time and no claim for extension by reason of such default will be allowed.

SP-04.2 Omitted Particulars

All works and matters omitted from the Contract but which may reasonably be implied or inferred from them and in the opinion of the Engineer obviously are necessary for the efficiency, stability, completion and maintenance of the works and which are ordered by the Engineer to be carried out shall be executed by the Contractor accordingly as if they had been expressively described in or shown on the Contract documents and the costs thereof shall be deemed to be included in and covered by the Contract Price.

SP-04.3 Drawings

Not Included

SP-04.4 Drawings Supplied by Engineer

Not Included

SP-04.5 Shop Drawings

The Contractor shall make detailed analysis of the requirements of the works by visiting the site. Based upon such analysis he shall prepare detailed Shop Drawings at his own cost for HVAC System in the scope of this contract and Equipment. Initially he shall submit 3 preliminary copies each of all such Shop Drawings to the Engineer for obtaining approval. Once basic agreement is reached with the Engineer regarding the details then the Contractor shall submit 3 copies each of all such Shop Drawings for obtaining approval of the Engineer. After obtaining approval and after having in possession these approved Shop Drawings, the Contractor shall use these Shop Drawings for fabrication, construction and installation.

The work described on any shop drawing submitted shall carefully be checked by the Contractor for all clearances, field conditions, maintenance of architectural conditions and proper coordination with all trades on the job. To this end, the Contractor during the shop drawing stage, shall ensure that he receives drawings of all other trades that might interfere with the proper installation of his work. No payment shall be made for any variations or alterations on site due to lack of knowledge of other trades. Any unresolved conflict between trades shall be referred to the Engineer for decision.

Equipment layout is to be detailed on shop drawings, showing the exact method of installing and clearly illustrating components to be used in making all connections.

The Position of hangers and supports with type and method of installation of each hanger shall be given in the Air Handling Unit Rooms, detailing the type of hanger fixing with a reference number for each type.

The Piping drawings must be fully detailed, showing all piping in double line and indicating the precise size of fittings, valves and equipment in the Plant room and Air Handling Unit rooms. Positions of hangers and supports with reference numbers must be given showing the type and method of installation of each hanger detailing the type of hanger fixings with a reference number for each type.

All general layout drawings shall be drawn to 1:50 (1':1/4") scale. Details of hangers, methods of fixing of pipes and ducts, detailed cross section of pipe, ducts and risers, details of control and piping hook-ups to equipment shall be drawn to 1:10 (1':1") scale.

The Contractor shall prepare Drawings and Schedules showing precise details of holes in concrete, masonry, etc. and necessary sleeves required for passage of ducts and pipes and plant, plant supports etc. Drawings

and Schedules, approved by the Engineer must be available before any structural work requiring holes or other modifications, is constructed.

Signed and approved drawings shall not be departed from unless a signed variation order or site instruction is issued in writing by the Engineer. Drawings returned to the Contractor for alteration or amendments are to be resubmitted for approval.

Amended or altered drawings shall show the nature of the amendment or alteration in a revision block on the drawing, together with revision number or letter and the date of the revision.

The Contractor shall be responsible for any discrepancies, errors or omissions in the drawings and other particulars supplied by him whether such drawings and particulars have been approved by the Engineer or not, provided that such discrepancies, errors, or omissions are not due to inaccurate information or particulars furnished in writing to the Contractor by the Engineer.

SP-04.6 As-Built Drawings

The Contractor shall supply to the Engineer a set of "As-Built" drawings showing the Contract works as installed, together with any other information necessary for operation and maintenance. Six copies of each drawing (scale as per shop drawing) and other information shall be supplied, along with a soft copy.

SP-04.7 Manufacturer's Data

Manufacturer's performance data, certified factory drawings and/or curves of apparatus giving full information as to capacity, performance at different operating and ambient conditions, dimensions, materials, electrical data and all information pertinent to the adequacy of the submitted equipment shall be submitted for approval. One original and 2 copies of catalogues and other information shall be submitted.

Manufacturer's names, sizes, catalogue numbers and/ or samples of all materials shall also be submitted for approval.

Orders for equipment submitted for approval must be accompanied by relevant drawings, curves, technical data, catalogues and samples. Where data, certified drawings or other required information is not available until after orders have been placed, the Engineer shall give provisional approval until all requested drawings and information have been supplied to the Engineer and approved by him. It is the Contractor's responsibility to ensure that all necessary information is supplied to the Engineer in accordance with the progress of works.

Should the Engineer give provisional approval only for an order due to lack of complete information and should the missing information not

eventually meet with the approval, the Engineer shall not be held responsible for any delay incurred. For equipment where information from the manufacturers is likely to be delayed, it is essential that the Contractor places provisionally approved orders at the earliest possible date so as to ensure approval of orders in complete conformity with the progress of the works.

Submittals and shop drawings should, as far as possible, be complementary so that drawings and submittals can be cross-checked.

SP-04.8 Samples

In case of any ancillary items to be replaced for the proper function of HVAC System, the Contractor shall provide at his cost, samples of materials, instruments, gauges and electrical items, for approval by the Engineer before order is placed for the same. Engineer may waive this requirement, if detailed published catalogues submitted by the Contractor provide sufficient information for approval. These samples shall include, but not limited to:

i) GI metal sheet
ii) Pipes and fittings
iii) Valves (all types), strainers, air vents, pressure gauges and thermometers
iv) Pipe insulation and covering
v) Insulation adhesive and tapes
vi) Vibration isolating springs, pipe hangers and rollers
vii) Pipe flexible connection/expansion joints (when specified local)
viii) Paints
ix) Anchor bolts, studs, etc. for hanging arrangements
x) Round insulation flexible duct
xi) Any other item required by the Engineer

SP-04.9 Copies of Drawings and Specifications

One set of Bidding Documents will be issued by the Employer to the Contractor free of cost after award of Contract. Additional sets will be provided at cost upon written request to the Engineer by the Contractor.

SP-04.10 Sound Absorption Data

The Contractor shall provide data for sound absorption from HVAC machinery, air terminals, etc. to ensure NC ratings TP-1.12.

SP-04.11 Photographs and Progress Reports

The Contractor shall arrange, at his cost, color photographs of Works in progress at Site. At least six photographs per month shall be taken from approved locations, commencing with the first month up to the completion of the Works. A professional camera shall be used. The Contractor shall

submit, not later than seventh of each month, a negative and six prints of 10x8 inch of each photograph taken during the previous month, with a brief report indicating progress of Works to date.

SP-05 APPROVAL OF MATERIALS AND EQUIPMENT

As soon as practicable after the award of Contract, the Contractor shall submit for the approval of the Engineer specifications, drawings, catalogue - cuts, diagrams and other descriptive data for all materials, components and equipment which the Contractor proposes for use under this Contract. For certain materials and equipment, data may be required to be submitted in accordance with a detailed form furnished by the Engineer. Items submitted shall be properly labeled to indicate the Contract number, project, manufacturer, source of supply, Contract Item number, and other data required by the Specifications. All items shall be submitted in sufficient time to permit proper consideration and action thereon without delaying the construction schedule. These data shall include original copies of proforma invoices for placing orders, a type written specification sheet of each SOP item, and technical literature (complete bound published catalogue) with relevant portions highlighted by a marker. Accessories to be included shall clearly be marked in catalogue and indicated in specification sheet.

SP-06 TIME FOR DELIVERY

All equipment plant and machinery shall be delivered at Site on such dates so as to ensure adherence to scheduled dates stated in Programs of works submitted by the Contractor and approved by the Engineer subsequent to the award of Contract. The Contractor shall keep the Engineer informed of the progress of the shipment and notify them approximately 02 weeks in advance, in writing, as to when the equipment will be ready for inspection at Site by the Engineer and shall supply lists covering each consignment in sufficient detail to enable Engineer to check the contents of the packages, if he so desires.

SP-07 STANDARDS AND CODE REQUIREMENT

SP-07.1 All equipment and materials under HVAC Scope of Works shall be furnished in conformity with the latest edition of Applicable Standards of ASME, ASHRAE, AHRI, SMACNA, TIMA, AMCA and applicable Government and Local Codes governing the same. In case of conflict, the strict requirements shown/specified shall govern. All equipment shall be rated and tested as per standards listed in ASHRAE Handbook (latest Edition).

SP-07.2 Abbreviations for Codes and Standards referred in the Contract are as under:

1) ASME - American Society of Mechanical Engineers
2) ASTM - American Society for Testing & Materials

3) ASHRAE - American Society of Heating, Refrigerating and Air-conditioning Engineers
4) NFPA - National Fire Protection Association, USA
5) AHRI - Air-conditioning and Refrigeration Institute, USA
6) SMACNA - Sheet Metal and Air-conditioning Contractors National Association, USA
7) CTI – Cooling Tower Institute
8) EUROVENT – European Committee of Ventilating Equipment Manufacturers
9) GOVERNMENT - Government of Pakistan
10) LOCAL - Local authorities of the city where the Project is located
11) I.E.E. - Institute of Electrical Engineers, London
12) NEMA - National Electrical Manufacturers Association, USA
13) AMCA - Air Moving and Control Association Inc., USA
14) P.S. - Pakistan Standards.
15) B.S. - British Standards.
16) TIMA - Thermal Insulation Manufacturer's Association, USA

SP-08 STANDARDS OTHER THAN THOSE SPECIFIED

Where the specifications provide requirements for material or equipment by specifying a standard such as for example, one of the American Society of Heating, Refrigerating and Air conditioning Engineers which has its origin in one country, it is not the intention to restrict the requirements solely to that standard and that country. Other standards, including standards of other countries, will be accepted provided the requirements thereof, in the sole opinion of the Engineer are at least equal to the requirements of the standards specified. The Contractor may propose to the Engineer an equivalent standard other than that specified, in which case he shall submit the proposed standards and all other information to demonstrate and prove his proposed standard is equivalent in all significant respects to the standard specified. All submissions must be made in the English language.

SP-9 PERMIT

The Contractor shall secure and pay for any necessary approvals, permits and inspections from Government or other controlling agencies where applicable as required by law, before commencing any work so as to avoid all delays during erection and turn over the official records of granting of permits to the Engineer. No reimbursements shall be made for such payments.

SP-10 SHOP INSPECTION, DAMAGES AND MATERIAL ORDER

SP-10.1 Inspection

SP-10.1.1 Inspection at Factory Premises

All major equipment to be supplied under this Contract which has been

manufactured or shop-assembled in or outside Pakistan shall be subject to inspection (if the Employer so desires) by Employer or its authorized representative at its point of original manufacture or final shop assembly before its dispatch to Site. The Contractor shall make necessary arrangements and provide all the facilities required for such inspection. The cost of travel, boarding and lodging of Employer, his authorized representative or the Engineer shall be the responsibility of the Contractor.

The Chiller shall be inspected and tested at the manufacturer's works.

For local items will inspection if required, Contractor will pay Rs. 3000/Day (Daily Allowance) in addition to cost of traveling, boarding or lodging for one Employer's representative and one Engineer's representative for the subject inspection.

For all imported HVAC equipment, the Contractor shall arrange at his own cost factory visit(s) for pre-shipment inspection/testing. One Engineer's representative and one Employer's representative accompany with Contractor's representative will visit manufacturer's premises. The Engineer's representative must be part of HVAC design team who is actively involved in HVAC design of the Project. Club class air tickets to and from inspector's home town, boarding and lodging, and transport for four persons shall be Contractor's responsibility. The Contractor shall arrange visa for the inspectors and all formalities and costs in this respect shall also be the Contractor's responsibilities.

In addition, the Contractor shall provide (for four persons) daily allowance in US$ for out-of-pocket expenses, at per dime rate per person currently recommended by Chamber of Commerce and Industry for foreign travelers on business visa or 200 US $ / day / person, whichever is higher. The number of days shall be actual days spent in travel calculated from the dates of travel from and to the home town of the concerned inspector, but not less than five (5) days. The daily allowance US$ in cash shall be provided before start of travel from hometown.

In case the pre shipment inspection is not available due to force majeure, the Contractor is to arrange a third-party testing of the equipment at manufacturer's facility. The cost adjustment will be made accordingly.

SP-10.1.2 Inspection at Karachi Port/Dry Port

All major imported equipment will be inspected at Karachi port/Dry port. The Contractor shall make necessary arrangements and provide all the facilities required for such inspection. The cost of travel, boarding and lodging of Employer, his authorized representative and the Engineer shall be the responsibility of the Contractor. In case of unavailability of such inspection, Engineer reserves the right to deduct suitable amount from Contractor's payment and subsequent inspection at dry port will be additional responsibility of the Contractor up to Engineer's satisfaction.

SP-10.2 Material Orders

Triplicate copies of material or equipment orders required in this Contract shall be furnished to the Engineer. All orders shall state the specification designation under which the material is to be furnished and shall bear reference to the drawing number, if any, pertinent thereto. Orders shall also state that material is subject to inspection and testing and shall show the required date of delivery of the material to destination.

SP-10.3 Acceptance of Materials

The acceptance of any material or equipment prior to shipment shall in no way relieve the Contractor of any of his responsibilities for meeting all of the requirements of the specifications and shall not prevent subsequent rejection if such material or equipment is later found to be defective.

SP-10.4 Damages, During Transportation, Storage and Installation

The Contractor shall be responsible for any damage of the Equipment/ material during transportation to site, storage and until satisfactory handling over the works. The Contractor shall replace any damaged equipment/ materials at his own cost.

SP-11 NAMEPLATES

The Contractor shall provide and attach to each major piece of equipment, a metal name and rating plate to be approved by the Engineer, giving the name and address of the manufacturer, the date and rating data. All ratings shall be in the British system. Large lettering on any of the parts will not be permitted. All ratings shall be in the unit system adopted for the project, unless otherwise authorized by the Engineer.

SP-12 DIRECTED AND REQUIRED ETC.

Unless otherwise stated, wherever in the Specifications or upon the Drawings the words, "directed", "required", "permitted", "ordered", "designated", "prescribed" or words of like import are used, it shall be understood that the direction, requirement, permission, order, designation,

or prescription of the Engineer is intended, and similarly the words "approved", "accepted", "satisfactory", or words of like import shall mean approved by, or acceptable or satisfactory to the Engineer unless otherwise indicated.

SP-13 SEQUENCE OF ERECTION

The sequence of erection of the Equipment shall conform to the requirements of the civil construction and of the Erection Instructions. Such information will be furnished to the Contractor by the Engineer upon request.

SP-14 FABRICATION, ERECTION, TESTING AND MAINTENANCE TOOLS PLANT & INSTRUMENTS

SP-14.1 The Contractor shall furnish special plant and tools for the complete and proper fabrication, erection and maintenance tools, plant & instruments of the HVAC Equipment. Tools shall include the type of tools not normally available in the market as standard tools and is generally manufactured especially for use with the HVAC Equipment. All lifting devices shall be accurately machined to fit the parts to be handled. The wrenches and tools for maintenance, insofar as practicable, shall be mounted on a suitable hardwood or steel board arranged for wall mounting and provided with means for ready identification. The Contractor shall also provide refrigerant charging Plant if and when required. No separate payment shall be made for providing Plant and Tools and the Contractor may withdraw the Plant and Tools after its use.

SP-14.2 The Contractor shall furnish and install sign board showing information about the project, name of Employer, Engineer and the Contractor, as directed by the Engineer.

SP-15 MATERIALS AND EQUIPMENT TO BE IMPORTED

Imported materials and equipment, whether procured from local market or imported especially for this project by the Contractor shall include, but not limited to the items listed hereunder. The Engineer may however issue a Variation later for use of locally fabricated item, if he is satisfied that specified requirements will be met.

a. Dual Fuel Direct-Fired Double Effect Absorption Chiller-Heater
b. Cooling Tower
c. Air Handling Units (AHUs)
d. GI metal sheet
e. Valves and Specialties.
f. Instruments and Gauges
g. Piping Expansion Joints and Flexible Connectors.
h. Vibration Isolators for Chillers, Pumps, when specified as Imported.
i. Piping Insulation and Insulation Tape, Sealing Tape, and Adhesive.

j. Chemicals.

SP-16 ERECTION SUPERVISORS AND OPERATING STAFF

SP-16.1 General

The Contractor shall provide the services of Erection Supervisors and Operating Staff in accordance with the requirements of the Conditions of Contract, of sub-clause SP-02.2 Services by the Contractor, and as specified herein.

SP-16.2 Work by Erection Supervisor

a) The Erection Supervisor shall direct the activities of Contractor's employees as they concern the installation, commissioning balancing and testing of the Equipment furnished under this Contract. The Contractor through his Erection Supervisor shall cooperate with other Contractors to whatever extent is necessary to produce an installation satisfactory to the Engineer in accordance with the requirements of the time schedule, the Drawings and the Specifications.

b) Erection Supervisor shall be present from the Commencement of Work and remain on Site until the substantial completion.

c) Should a disagreement arise between other Contractors and the Erection Supervisor, the matter shall be submitted without delay to the Engineer for his decision. Upon such decision, the Erection Supervisor shall proceed with the work in accordance therewith, immediately.

d) Erection Supervisor shall be a graduate HVAC or mechanical engineer, registered with Pakistan Engineering Council, having at least 7-8 years of experience in HVAC installation works of similar nature.

e) If the Contractor fails to fulfill his obligations under clause SP-02.2(a) and also fails to provide the Services of the Erection Supervisor having the minimum qualifications as stated in sub-clause (d) of this Clause then the Contractor would be obligated to pay to the Employer an amount of Rs.1500 per day for the number of days when the services of such Erection Supervisor are not provided. The Employer would be entitled to deduct the amount due from the Contractor in this regard from his running Bill/any payable sums.

f) Provision of (e) above shall not apply when the Erection Supervisor is on authorized legal leave (casual), sick leave and official holidays only. His absence up to a period of ten (10) days will also be allowed when the Contractor intends to replace the Erection Supervisor with the consent of the Engineer.

SP-16.3 Operation and Maintenance Staff

The Contractor shall provide staff to operate and maintain the newly installed HVAC system during the One year's Defect Liability Period and whenever the HVAC facilities required. Operation and Maintenance supervisor shall be a graduate HVAC or mechanical engineer, registered with Pakistan Engineering Council having at least five (05) years' experience in HVAC Maintenance of similar plant or a three (03) year diploma holder from Government College of Technology in HVAC Technology having at least ten (10) years' experience of similar plants. The Contractor shall also arrange to provide proper training to Employer's staff to operate the HVAC system to the entire satisfaction of the Employer. All costs incidental to providing maintenance staff including staff salaries shall be deemed to be included in relevant item of Schedule of Prices.

SP-16 RIGHT TO OPERATE PLANT

The Employer reserves the right to operate any and all Equipment after it has been Commissioned and prior to substantial completion of whole Works. All repairs or alterations found to be necessary during such operation, and required of the Contractor, shall be made by the Contractor at such time as directed by the Engineer. The repairs or alterations shall be made in such a manner and at such a time as will cause the minimum interruption in the use of the Equipment by the Employer.

SP-17 ERECTION INSTRUCTIONS

Erection Instructions in form of published installation manual, as furnished by the manufacturer of each HVAC equipment listed hereunder shall be provided by the Contractor.

1. Dual Fuel Direct-Fired Double Effect Absorption Chiller-Heater
2. Cooling Towers
3. Air Handling Units

These instructions shall include full and detailed instructions for the guidance of the Erection Supervisor as to all procedures and precautions to be observed in erecting, assembling and adjusting the Equipment and as to the use of the Erection Plant. It shall include or be accompanied by drawings, clearly showing erection marking and particularly any matchmaking and shall embody in particular a full statement as to erection tolerances to be observed.

These shall also include full instructions for the maintenance of the Equipment not only during the period of Contractor's liability but more particularly during its operating life. The directions shall be set out simply, clearly and systematically. In particular this section shall include a full list of all routine checks and their timing, directions as to fault finding, detail of

all routine attentions (such as greasing), in the form of check sheets for daily, weekly, monthly, quarterly, half-yearly, yearly and any other periodic checks recommended by the manufacturer. This section should also provide detailed and complete instructions for trouble shooting, maintenance and all necessary adjustments to the Equipment. Technical leaflets and brochures in respect of all equipment supplied under this Contract including all relays, instruments, switches, controllers, regulators etc., should be supplied with the erection instruction. This should also include complete catalogue of spare parts with exploded views of the equipment and relevant part numbers to facilitate identification and ordering of spares throughout the operating life of the Equipment.

The Contractor shall submit 3 copies to the Engineer for approval.

SP-18 WATER, POWER AND GAS DURING ERECTION AND TESTING

Water and power supply for Erection and Preliminary Tests shall be the responsibility of the Contractor. Water, power, diesel and gas supply for Balancing & Commissioning, Performance Tests and Reliability Trial Tests and operation during Defects Liability Period will be provided by the Employer.

SP-19 SPARE PARTS

The Contractor shall furnish spare parts as required in Technical Provisions. The Contractor shall also furnish recommended spare parts with the recommendation of manufacturer of equipment and provide a list of such spares. No separate payment shall be made for spare parts and all prices shall be included in equipment prices.

These spare parts shall not be used during Defects Liability Period, or earlier.

The Contractor shall supply, at his own cost any spare parts required during the Defects Liability Period. The Contractor shall also provide unit rates of essential spare parts for all equipment. The rates shall be valid for two (02) years beyond defects liability period.

SP-20 DEFECTS LIABILITY PERIOD

The Contractor shall operate service and maintain complete new HVAC System for a period of Three Hundred and Sixty Five (365) days after date of issuance of Substantial Completion Certificate. The plant shall be maintained as specified herein, and shall include supply of maintenance staff, consumables, all necessary adjustments, greasing, oiling and cleaning and the furnishing of necessary tools, instrument supplies and parts to keep the system in perfect operation, except such parts made necessary by misuse or neglect not caused by the Contractor.

The cost of operation and maintenance of the plant during Defects

Liability Period shall be paid by the Employer to the Contractor under Schedule of prices item named “HVAC System Operation during Defects Liability Period As specified”.

SP-21 APPROVAL FROM GOVERNMENT

The Contractor shall arrange and be responsible for all tests, test reports and approvals regarding electrical works under this contract, any other works under this Contract requiring tests/Government approvals. All the requirements to be completed for this purpose, whether specified or not shall be at the cost of the Contractor. The Contractor shall handover all test results and approval certificates to the Engineer within one week of obtaining such approval.

SP-22 PERFORMANCE GUARANTEE

The Contractor shall be required to furnish a Performance Guarantee in accordance with Conditions of Contract.

SP-23 SITE FACILITIES

Except for the Site facilities specifically stated in Conditions of Contract and/or Special Provisions, no other site facility shall be provided by the Employer to the Contractor.

SP-24 SUFFICIENCY OF RATES AND CURRENCY FOR PAYMENT

All rates and amounts filled in the SOP by the Contractor for equipment/material whether locally procured or imported shall be deemed to include cost of item, taxes and duties etc. as per Volume-I.

SP-25 IMPORT LICENSE

The Contractor will arrange the import licenses if required for all the imported Equipment, Plant, Tools and Machinery to be incorporated in permanent works. All the costs and charges for arranging import licenses will be paid by the Contractor. The Contractor shall be responsible to arrange foreign exchange for import of all equipment and materials.

SP-26 GUARANTEES AND WARRANTIES

SP-26.1 Performance Guarantee

The contractor shall guarantee the performance of the complete HVAC system, viz.-a viz. his workmanship for the work executed at site, and quality of material, as specified. He shall replace the material/workmanship, whenever found not meeting the specified requirements, at his own cost.

SP-26.2 Manufacturer's Warranties

The Contractor shall provide manufacturer's standard warranties for all

equipment for one (01) year after issuance of substantial completion certificate.

SP-27 PACKING OF EQUIPMENT AND MATERIALS

All equipment and material shall be adequately packed at the manufacturer's works to protect them against damage, scratching, corrosion, dust, rain and moisture during handling, transportation and storage. The packaging shall be rigid enough to withstand normal service incidental to shipping and handling. Wherever necessary, crates/boxes shall be provided with lifting hooks attached by means of vertical rods or plates to strong bottom supports to enable rigging.

The following information shall appear inside all packages:

a) Stock or identification number
b) Description of contents/packing list
c) Quantity of each item
d) Invoice number
e) Year of manufacture

SP-28 INSPECTIONS AND TESTS

SP-29.1 Inspection by Engineer at Site

The Engineer shall inspect the works in progress at site as and when considered necessary by the Engineer and the Contractor shall provide full access and assistance to the Engineer for carrying out inspection to verify the conformity of works to general lay-out of HVAC System as designed and as shown on Drawings and as specified. Such inspection if made shall not relieve the Contractor from any obligations under the Contract.

SP-29.2 Tests

A) General

i) All Tests as specified shall be carried out unless otherwise specified. The Engineer shall witness the tests.

ii) The Contractor shall give the Engineer at least seven days notice in writing of the date on which any equipment will be ready for inspection and/or testing as provided in the Specifications and unless the Engineer shall attend within seven days of the date which the Contractor has stated in his notice the Contractor may proceed with the tests in the Engineers absence and shall forthwith forward to the Engineer five duly certified copies of test readings, on the forms prescribed by the Engineer. The Engineer shall give twenty four hours notice in writing of his intention to attend any test.

iii) The Contractor shall provide all labor, materials, electricity, fuel, stores, apparatus machines and instruments as may be necessary to carry out tests, unless otherwise specified.

iv) The cost of all tests carried out by the Contractor under this Clause shall be borne by the Contractor if such tests are clearly intended by or provided for in the Specifications or Schedule of Prices.

v) As and when any equipment or HVAC System or part thereof shall have passed any inspection/test the Engineer shall furnish to the Contractor a certificate in writing to that effect.

vi) The Engineer may reject any part or parts of Equipment, and HVAC System which he shall after inspection/ testing decide is not in accordance with the Specifications and Drawings and he shall give to the Contractor within fourteen (14) days of such inspection/ testing notice in writing of such rejection stating therein the grounds upon which his decision is based.

vii) The test results shall be filled out by the Contractor in the forms proposed by the Contractor and approved by the Engineer. Three copies of filled out forms shall be submitted to the Engineer for review and approval.

B) Once the inspection/test certificate has been obtained by the Contractor, as stated in A (v) above, the Contractor shall test and balance the system in accordance with NEBB (National Environmental Balancing Bureau), USA, code of practices. The Contractor shall be responsible for all remedial measures if any, required. The Contractor shall be responsible for the following:

Supply and fixing of any test hole covers, paint, gauges, gadgets, testing and balancing instruments, or any such thing which is necessary to carry out this work.

To provide all supervision, labor and materials required to carry out these balancing works.

C) Preliminary Inspection & Tests

Preliminary Inspection/Tests as specified in Technical Specifications shall be carried out on all or any major HVAC equipment and such other equipment as the Engineer may require, on completion of installation of that equipment or at such time which the Engineer may require.

D) Balancing & Commissioning

Balancing and Commissioning shall be carried out on all or any major equipment, as Specified in Technical Specifications, when such is ready for operation. The Engineer must witness the Balancing and Commissioning procedures and Contractor shall proceed further after Engineer's written satisfactory approval.

E) Performance Tests

These tests as specified in Technical Provisions shall be carried out on each equipment of HVAC system after successful completion of Commissioning of that equipment, during appropriate season, on the dates proposed by the Contractor and approved by the Engineer. The Engineer keeping in view the weather conditions may fix the test date on any equipment of HVAC system within 6 months of Completion of Commissioning of that equipment.

F) Reliability Trial Tests

i) During the Defects Liability Period the Contractor shall inform the Engineer in writing of his readiness to commence the Reliability Trial Test of HVAC System or part thereof. Cooling or Heating Tests shall be carried in appropriate season and the Engineer shall, within fourteen (14) days of receipt of such information shall forward his consent for commencement of Reliability Trial Test as specified in Technical Specifications, after having satisfied that all the requirements for such Tests have been completed.

i) If any Reliability Trial Test be not fulfilled to the satisfaction of the Engineer, such test shall be repeated at such time as the Engineer.

SP-30 Dismantling of Existing HVAC System

The contractor will be responsible for dismantling of existing system by fulfilling standard HSE requirements. The workers shall use safe procedure for dismantling/ removal of existing equipment/material. Provision of all relevant safety gadgets and fire extinguishing equipment will be responsibility of contractor.

The contractor will be responsible for removal of dismantled equipment/material from site and maintain the site as per original condition after removal of equipment as per standard procedure.

TECHNICAL PROVISIONS

SPECIFICATIONS

TECHNICAL PROVISIONS FOR HVAC WORKS
SECTION 1 - GENERAL REQUIREMENTS

1-01 MATERIAL

All materials shall be of the highest grade, free from defects and imperfections, of recent manufacture and unused, and of the classification and grades designated, conforming to the requirements of the latest issue of the appropriate specifications cited herein. All materials, supplies, and articles forming part of major equipment and not fabricated by the manufacturer of the equipment shall be the products of the recognized reputable manufacturers.

1-02 WORKMANSHIP

Workmanship and general finish shall be of the highest grade, in accordance with the requirements specified herein, and the best modern standard practice.

1-03 EQUIPMENT

a) For ratings and characteristics of manufactured equipment, Equipment Schedule as appended to Technical Provisions shall be followed.

b) All equipment shall be manufactured by companies, which have had at least ten years previous experience in the design and manufacture of equipment of comparable type, capacity and operating conditions. Unless otherwise approved by the Engineer.

c) Where the requirement of this Clause makes any equipment proprietary or non-obtainable, the Engineer reserves the right to waive any portion or portions of it as required to obtain the intent of the technical specifications (s).

d) When a manufacturer's product is specified by name, or equivalent, it shall be in the sole judgment of the Engineer as to acceptability of any product, which is offered as equal to that specified.

e) Where two or more units of the same class of equipment are furnished, product of the same manufacturers shall be used: component parts of entire system need not be product of same manufacturer.

1-04 CHASSES AND OPENINGS

The Contractor shall provide shop drawings, templates or details for chases and openings to be left in concrete walls, concrete partitions, and floor or roof slabs to accommodate work under HVAC scope of works.

1-05 PROTECTION

The Contractor shall keep pipe, duct and other openings closed to prevent entry of foreign matter. All fixtures, equipment and apparatus shall be covered and protected against dirt, water, chemical or mechanical damage, before and during the construction period. All fixtures, apparatus, or equipment damaged including damaged shop coats of paint shall be restored to original conditions prior to

Commissioning and also again prior to Final Acceptance. All bright finished shafts bearing housings and similar items shall be protected until in service: no rust will be permitted.

1-06 CUTTING, PATCHING AND REPAIRING

Required for proper installation and completion of HVAC works, including masonry work, concrete work, carpentry work, painting and re-painting shall be performed by skilled craftsmen in respective trades, at expense of the Contractor. Construction shall be cut only after obtaining written permission from the Engineer.

1-07 LINES, LEVELS AND SPACES

The Contractor shall check dimensions at the building site and establish lines and levels for work specified in Specifications. The Contractor shall check with work of other trades to ensure proper clearance of piping, ductwork, conduit and other items. Any deviations observed between drawings and actual construction shall be brought to the notice of the Engineer. The erection supervisor shall regularly inspect, during progress of civil works, the areas allocated for installation of HVAC equipment and any conflict observed shall immediately be reported to the Engineer.

1-08 MACHINERY GUARDS

All moving parts of machinery are to be protected by strong guards to adequately protect all personnel working on or in the vicinity of equipment.

Wherever possible, moving parts should be protected by guards supplied by the equipment manufacturer. All guards must be strongly attached to equipment and should be designed for easy removal for access, servicing, adjustment and maintenance.

1-09 TOOLS

The Contractor shall supply in a toolbox, full sets of tools suitable for maintenance of all components of the plant furnished by him including the electrical equipment, for use by the Employer after completion of Maintenance Period. List of Tools shall be subject to approval by the Engineer.

1-10 OIL AND GREASES

The oils and greases shall be supplied in sealed containers. These shall be of suitable quality sufficient for the initial charge plus hundred percent (100%) extra. The quantity, grade of oil and greases and their manufacturer shall be approved by the Engineer the extra oils and greases shall be reserved for use by the Employer after completion of Defects Liability Period.

1-11 SPARE PARTS

The spare parts for HVAC System shall be duplicates of the original parts with same country of origin furnished and interchangeable therewith.

1-12 ACOUSTIC TREATMENT

The noise criteria for different areas stated in Special Provisions is to be obtained.

Sound measurements will be made at approximately five (5) feet above floor level in the occupied area served and not more than five (5) feet from the grills, diffusers or other air devices being tested. Instruments for sound measurement shall be provided by the Contractor.

Provision is to be made to minimize noise and vibration. However, different manufacturers equipment have varying sound and vibration characteristics and it is, therefore, the responsibility of the Contractor to ensure that the requirements in these specifications are fully met by the equipment he is offering. If the Contractor has any requirements for additional vibration or sound isolation, these must be incorporated into the price quoted.

All equipment installed should not be audible inside the occupied areas and the Contractor must ensure that all equipment he is offering is quiet and have satisfactory sound levels. Where silencers are required, these must be incorporated into the price quoted.

1-13 ACCESS PANELS

The Contractor shall mark locations of, and give sizes of, access panels required in false ceiling and wall paneling for adjustment and maintenance of HVAC Equipment, such as Dampers, Fire Dampers, valves, ceiling-hung equipment, etc. This information shall be provided to the Engineer before commencement of false ceiling work by the concerned persons.

1-14 SEALING OF OPENINGS

The contractor shall seal all openings in external walls and roof where HVAC ducts/pipes penetrate in external membrane. The sealing shall be air tight to prevent penetration of outside air and water into building. The method and materials for sealing shall be subject to Engineer's approval.

SECTION 2 – EQUIPMENT

2-01 GENERAL

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. 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.

Provision for clearance and service spaces shall be made around all mechanical equipment as recommended by equipment manufacturers.

All equipment supplied under this section shall be brand-new, factory manufactured and factory assembled (unless otherwise specified) and complete in all respects. The type, characteristics, capacity ratings, component sections of all equipment shall be as Scheduled.

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

All power driven equipment shall include drives, motors and adjustable motor foundation bases and accessories including machinery guards where applicable.

All equipment shall be completed with all accessories necessary to serve the intended purpose, whether specified or not.

All equipment installed on roof or intermediate floors shall include suitable vibration isolators to prevent any vibration traveling to building structure.

2-02 Dual Fuel Direct-Fired Double Effect Absorption Chiller-Heater

2.02.1 General

This shall be Dual Fuel Direct-Fired Double Effect Absorption Chillers-Heaters of characteristics and capacity as shown in "Equipment Schedule" Direct Fired Absorption Chiller-Heater. Technical deviations from this specification may be considered when these fulfill the intended purpose. The Chiller shall be heavy duty type capable to operate 24 hours a day, 7 days a week for complete summer/winter season.

Chillers-heaters shall be manufactured as per latest industry standards of Japan. The ratings shall be in accordance with JIS Standards. The compliance with JISB8622 for absorption chiller is mandatory.

The Chillers-heaters shall be externally insulated as per recommendations of chiller-heater manufacturer.

The Chillers-heaters shall have microprocessor based controls compatible, with Microprocessor-based control system (Building Management System) of this project including interface equipment as required. All Chiller data will be displayed on Control System for monitoring and control. The list of displayed data will be

provided by Contractor during technical submission for Engineer's approval.

Unit shall be complete chiller-heater package and shall include an evaporator/absorber section, condenser/low temperature concentrator section, high temperature concentrator/economizer section and complete burner assembly.

The shell material is to be of carbon steel fusion welded seems with carbon steel tube supports.

Tubes in absorber, evaporator and condenser shall be seamless copper in low pressure generator copper-nickel alloy tubes.

All tubes shall be roll expanded into steel sheets except high pressure generator tubes, which shall be welded at both sides.

The Chiller-heater shall be provided with Automatic Purging System. Manual purging pump set for schedule maintenance is also included in scope of Chiller supply.

2-02.2 Partial Load Efficiency

During partial load operation the machine shall allow reduction of fuel consumption with maximum efficiency. The control of fuel consumption up to 50% shall be included in the machine.

2-02.3 Refrigerant

The initial charge of Refrigerant and Lithium Bromide solution shall be provided separately to be charged at site at the time of commissioning.

2-02.4 Chilled Water

The chilled water and hot water outlet temperature as specified shall be maintained constant by providing automatic temperature controller which shall search chilled/hot water outlet temperature and shall control the fuel control valve.

2-02.5 Condenser Water

Chiller shall be designed to operate on entering cooling water temperature and fouling factor as given in the equipment schedule.

2-02.6 Capacity Control

The capacity of unit shall automatically be adjusted between 25 to 100% of the full load capacity. An automatic start-stop thermostat shall be provided to stop the chiller when chilled water outlet temperature falls below the pre-determined field adjustable specified temperature.

2-02.7 Burner

A fuel burner as scheduled, capable of operating on natural gas and on high speed diesel shall be included.

The burner must be complete in all respects for full automatic control to operate

the chiller-heater within the specified limits with precision and safety.

If the burner/chiller combination is operating outside the set points, but within operating limits, operator is to rectify minor deviations. However, in case the deviations result in the burner/chiller combination working outside the operating limits, the machine must provide for automatic shut down within safe limits.

It is expected that the burner system will cover the following functions for which all necessary ancillaries/auxiliaries will be factory fitted and wired/connected.

a) Safety control circuiting

Key operated master control switch (four sets of key to be provided).

b) Safety interlocks comprising of:

1. High/low temperature switch
2. Low liquid level cut-of switch
3. Forced draft fan interlock
4. Low/high gas pressure switches

c) Main burner fuel system

1. Fuel Automatic shut-off valves (i.e. wire controlled fuel safety shut off valves)
2. Main fuel variable valves (with position indicators)
3. Mechanical remote control (i.e. wire controlled fuel safety shut off valves).
4. Pilot flame, automatic, fuel shut-off valves
5. Pilot/Main burner fuel interlock switch
6. Spark Ignition indication
7. Pilot flame Ignition Indication
8. Main Flame Ignition Supervision (Photo- electric or equivalent sensor
9. Pilot Flame 2 to 4 second failure response time -3 cycles
10. Main Flame failure response - 5 to 9 second; 2 to 4 cycle

The Machine shall shut down automatically due to any one or more of following causes:

1. Ignition failure
2. Forced Draft fan failure
3. Main Flame Failure
4. Low & High Gas pressure
5. Low & High Liquid level

The Auxiliaries/Ancillaries to be factory fitted or loose-supplied for field installation to each fuel burner system are mentioned below. It is not an exhaustive list but only an indication of the various components that may be taken to make up a complete system.

a) Pilot and Main burners
b) Flame Scanners
c) Ignition Transformer
d) Protection Relays

e) Microprocessor based Burner Control Panel incorporating pilot and/Main Ignition initiating devices complete with deviation and cycle controls, Hours Run Meter, Key operated Master Switch, Various electronic/electrical interlocks /relay etc., programmed to function in conjunction with operating Parameters of the Chiller.
f) Main & Pilot burner automatic safety shut-off valves.
g) Main & pilot burner mechanical remote control (wire operated) fuel safety shut-off valve.
h) Pilot gas regulator
i) Main burner variable discharge fuel control valves (for metering fuel)
j) Pilot gas regulator
k) Pressure, temperature and level sensor as appropriate.
l) Strainers for fuel (duplex type)
m) Temperature and pressure gauges
n) Tubing, both rigid and flexible as appropriate lagged and armored where applicable.

2-02.8 Status Diagnostic

Unit status and diagnostic control monitor on the panel shall define status. The unit control system shall be interconnected with the other safety interlocks such as water flow sensors pumps, cooling towers etc. for proper unit operation.

The control panels of the chillers-heaters should have provision for hooking-up to main HVAC control panel.

2-02.9 De-crystallization

A system shall be provided to transfer hot solution directly from the generator to absorber during crystallization systems to return the unit automatically to normal operation.

2-02.10 Thermometer Wells

Thermometer wells shall be provided at the inlet/outlet of chilled water and condenser water circuits.

2-02.11 Co-efficient of Performance

Direct fired absorption chiller/heater shall be of minimum COP 1.3 (at full load) from the approved make.

2-02.12 Flue Collar

Chiller/Heater shall have flue collar for connection to breaching with structural angle flange and bolts.

2-02.13 Rating

The chillers/heater shall have a capacity and characteristics as shown in Equipment Schedules.

2-02.14 Essential Spares for Chillers

Sr. No.	Spare Parts	Qty	Unit
1	Absorber pump	1	No.
2	Refrigerant pump	1	No.
3	Automatic Purge pump	1	No.
4	Manual Purge pump	1	No.
5	Sight glasses	3	Nos.
6	Gaskets for absorber evaporator & condenser	1	Set
7	Packing (sight glass)	3	Nos.
8	Inhibitor	25	Liters
9	Relays	1	Set
10	Temperature controller (Refr)	2	Nos.
11	Protect Relay	1	No.
12	Flow switch	1	No.
13	Temperature sensor	1	No.
14	Temperature sensor (Ext. Gas)	1	No.
15	Fuse	2	Nos.
16	Pressures Switches	1	Set
17	Flame detector	1	No.
18	Transformer	1	No.
19	Pilot solenoid valve	1	No.
20	Control motor	1	No.
21	Shut-off gas valve	2	Nos.
22	Pilot regulator	3	Nos.
23	Timers	1	Set
24	Microprocessor Card	1	Set
25	Lithium bromide	10% charge for each chiller	

2-02.15 Integration with Building Management System:

The controller shall be integrated with BMS on open protocols, preferably BACnet over IP, thorough local area network (LAN). For this purpose, LAN port (RJ-45) shall be available in controller.

2-02.16 Special Requirement

a) Water/humidity proof casing for chiller export

2-03 CHEMICAL FEEDER AND CHEMICALS

2-03.1 Chilled/Hot Water Chemical Feeder

The Contractor shall provide chemical feeder for chilled/hot water system. Gravity Bypass Feeders shall be installed at the pumps as shown on Drawings. Gravity Bypass Feeder shall be complete with necessary valves. Make of Feeder shall be subject to Engineer's Approval.

2-03.2 Condenser Water Chemical Feeder

The Contractor shall provide chemical feeding system comprising of electrically operated pump with manual start/stop button and suitable piping system with

necessary number of drums to feed various types of chemicals required for the treatment of condenser water system. The make of chemicals and its feeding system shall be subject to Engineer's approval.

2-03.3 Chemicals

Sufficient chemicals for Preliminary Tests, Balancing Commissioning and Reliability Trial Tests and Operation during Maintenance Period shall be included. In addition to the above, sufficient quantities of chemical for further one year operation shall be handed over to the Employer at the expiry of Maintenance Period.

2-03.4 Chemicals for Chilled/ Hot Water

The quantities of chemicals shall be based on system volume stated in Expansion Tank schedule and 104 weeks with 24 hours & 7 days a week operation. Over and above chemicals for initial and passive doze of 2 weeks shall also be supplied.

2-03.5 Chemicals for Condenser Water

The quantities of chemicals shall be based on system volume with 7 days a week & 24 hours operation for 70 weeks. Make-up quantity shall be calculated on 80% average load. Over and above chemicals for initial and passive doze of 2 weeks shall also be supplied. Sufficient chemicals, as described in Clause 2-03.3.1 shall be furnished.

2-04 COOLING TOWERS (CTI/JCI CERTIFIED)

The cooling tower(s) shall be of type, characteristics and capacity as scheduled in Equipment Schedules. Packaged type, induced draft cross flow, low noise (maximum 72 db at 5 feet from fan discharge) square vertical discharge cooling tower with PVC internal piping and shipped in knocked down condition for field assembly.
The tower shall be heavy-duty type designed to provide more wetted surface for uniform water distribution and higher heat transfer rate.

The casing shall be Fiberglass (FRP) construction with all frame members bolts, nuts, washers and steel shall be galvanized/stainless steel. Louvers may be integral with fill.

Hot water distribution basin shall have non-ferrous diffusing type metering orifices.

The PVC louvers, fill and eliminators shall be self extinguishing for fire resistance and shall be impervious to rot, decay, fungus or biological attack. Eliminators shall ensure entrainment of moisture in air and drift loss of less than 0.1% of the total water circulated. Stainless steel positioning rods shall be provided for holding & keeping the fill in correct position.

Fans shall have die cast aluminum blades with fine finish. Blades shall be adjustable and individually attached to the hub. Fans shall be belt driven. Fan motors and drive shall be heavy-duty type suitable for cooling tower application. The motor shall be two-speed type. Temperature sensor shall be provided in the cold-water basin to set the motor to low or high speed.

Float operated make-up valve and sump complete with suction screen and anti-cavitations device shall be provided.

The Cooling Tower shall be supplied complete with galvanized steel access ladder for safe access to fan deck and access door for access to inside of tower. Galvanized steel handrails, knee rails, toe board and heavy gauge galvanized wire mesh fan guard shall be provided around tower perimeter. The anti vibration spring isolators shall be included in cooling tower manufacturers scope of supply. The cooling tower controls shall be compatible with HVAC Controls.

The motor make, country of origin and model no. shall be identified during technical submission and shall be from manufacture's best ranking make, most efficient and shall be included in manufacturer's scope of standard. The motor shall be capable of operating at ambient temperature of 50°C ambient shall be minimum IE3 type.

2.04.1 Spare Parts for Cooling Tower

a)	Showering Nozzles	10 No.
b)	Driver Belts	2 each Size

2-05 AIR HANDLING UNITS (EUROVENT CERTIFIED FOR MECHANICAL STRENGTH & PERFORMANCE)

2-05.1 General

The characteristics and capacities of air handling units shall be as scheduled. The configuration of component sections shall be as scheduled and as shown on Drawings. All AHUs shall complete with drives, motors, and belts. These shall include mixing box with dampers, filters and humidifiers when scheduled. Filter specifications are given separately in this section.

AHUs shall be of imported origin as mentioned in equipment schedule or list of approved equipment/material or approved by the Engineer.

For purpose of calculation of motor BHP, specified external SP and AHU manufacturer's internal SP should be added. Filter pressure drop shall be part of internal SP, which shall be calculated on average of clean (initial) and filter manufacture-recommended dirty (final) pressure drop. Published recommendation of filter manufacturer shall be furnished along with technical submittal. In case published recommendation is not available, a recommendation on the printed stationery of filter manufacturer shall be acceptable provided the manufacturer certified that no such published data is available. Motor HP shall be at least 120% of calculated BHP.

The EUROVENT certified air handling units shall meet the requirements of ARI 430-86 and ASHRAE 51-85 standards and shall be factory tested according to the requirements of these standards. The minimum mechanical strength standards for AHUs as per Eurovent certification are as follows;

1- Casing Mechanical Strength (D1)
2- Casing Leakage (L1/L2)
3- Thermal Transmittance (T2)
4- Thermal Bridge Factor (TB2)
5- Bag Filter Leakage Pass (F9)

The (EFF3, TEFC, CLASS F Insulated, VFD Compatible) motors make, country of origin and model no. shall be identified during technical submission and shall be from manufacture's best ranking make, most efficient and shall be included in manufacturer's scope of standard.

The Air Handling Units (AHUs) shall be medical grade type.

Cleaning methodology, general arrangement and dimension of the AHU including location of doors and/or hatches shall be including in the Installation and Operation Manual of the product.

2-05.2 Construction

These shall be factory assembled draw-through packaged air handling unit of capacities and characteristics as scheduled. Air handling units shall be horizontal or vertical with component and configuration as scheduled and shown on the drawings.

Large AHUs may be shipped in sections e.g. Fan Coil Section, filter section, mixing box section for ease of transportation and rigging.

AHRI Certified (AHRI 410-91) Coils shall be of copper construction with mechanically bonded smooth aluminum fins, suitable for chilled water and hot water applications.

Fan shall be high efficiency (Airfoil/ Backward Curved) mounted on a common shaft. Fan impeller shall be statically and dynamically balanced and shall have permanently lubricated bearings. Fan shall be belt driven with adjustable sheaves. Fan shall have spring isolation from the casing. All fans shall be in accordance with AMCA 210 Standard for performance.

Casing shall be made of sheet steel and finished with baked enamel. (Or approved by the Engineer) The casing shall be double skin with minimum 1-1/2 inch thermal insulation between the skins and removable panel type. AHU shall be equipped with factory fabricated filters and filter boxes with side access door.

The medical grade AHUs shall have inner surfaces of stainless steel. Before coating with the stainless steel, an antibacterial silicon sealant is applied to the unit to prevent water leakage to the bottom part. The unit shall be coated with antimicrobial powder.

All coil bases and sledges shall be made of Cr-Ni stainless steel.

All AHUs shall be supplied with factory built in VFD compatible for the motor.

A condensate drain pan, with double wall construction and insulation in between, shall be provided as per ASHRAE 62.1-2010. Inner pan shall be finished with a factory applied coating of corrosion resistant material. Insulation, adhesive and inner coatings shall comply with NFPA-90A Standard.

Flat filters installed in Air Handling Units, shall be permanent, impingement, dry type, washable, all metal, panel type, at least 2 inch thick unless otherwise scheduled. Media shall be aluminum screen, arranged in alternate layers of flat and herringbone-crimp, 4 layers of each per one inch reinforced and enclosed in a

frame of 16 gauge galvanized steel with flush mitered corners. Initial pressure drop at 500 FPS shall not exceed 0.1 inch WG. Holding frame shall be factory-built of 16 gauge steel; with felt air seal. Filters shall have at least 35% efficiency on 0-5 microns range when tested in accordance with ASHRAE Standard 52-76.

Bag filter (if schedule) in AHUs shall be extended surface dry type non-supported pocket, cartridge filter. Average efficiency shall not be less than 90% when tested as per ASHRAE standard 52. Initial resistance at 500 FPS shall not exceed ½ inch.

Steam humidifiers of capacity as per equipment schedule shall be of self-contained, electronically controlled design suitable for installation in AHUs. Humidifier shall generate steam from ordinary tap water. It shall have full modulating control to provide 0 to 100% capacity. Drain cycle will be self-regulating for automatic control of mineral (conductivity) build-up. Humidifier shall have programmed diagnostics to confirm that input and output circuits are functioning. The humidifier steam generator shall be of cleanable type which can be taken apart for inspection. The electronic circuit shall provide automatic protection from excessive electrode current. The humidifier fill water line shall have an air gap to prevent backflow. Humidifier shall have interface for BMS integration and control. It shall be supplied with stainless steel steam dispersion tube and with condensate connections.

2-05.3 Spare Parts for Air Handling Units

Following spare parts shall be provided as a minimum along with the spares recommended by the Manufacturer.

a)	Fan Belts	01 set for each AHU type
b)	Mechanical Seal	01 set for each AHU type
c)	Motors	01 for each AHU type
d)	Contactor	01 No. for each AHU type
e)	Contactor Thermal Overload	01 No. for each AHU type

2.06 FILTERS

Flat filters shall be permanent, impingement, dry type, washable, all metal, panel type, at least 2 inch thick unless otherwise scheduled. Media shall be aluminum screen, arranged in alternate layers of flat and herringbone-crimp, 4 layers of each per one inch reinforced and enclosed in a frame of 16 gauge galvanized steel with flush mitered corners. Initial pressure drop at 500 FPS shall not exceed 0.1 inch WG. Holding frame shall be factory-built of 16-gauge steel; with felt air seal. Filters shall have at least 35% efficiency on 0-5 microns range when tested in accordance with ASHRAE Standard 52-76.

SECTION 3 - FOUNDATIONS AND SUPPORTS

3-01 GENERAL

All equipment, piping and ductwork where used shall be mounted on or suspended from foundations and supports, all as specified, as shown and as required. All concrete foundations where required, including thickened structural slab, housekeeping pads and concrete for inertia pads will be provided by the Employer or other Contractor appointed by the Employer or HVAC Contractor as described in Special Provisions Clauses SP-02 & SP-03.

Shop drawings, other information and templates for all concrete foundations where used, shall be provided by Contractor as per recommendations of the manufacturer of the equipment. Necessary integral steel framings, concrete reinforcing rods welded to frame, required anchor bolts, spring mountings, and neoprene pads, shall be provided by the Contractor. The Contractor shall cooperate with those doing the flooring work to ensure proper installation of all these elements.

Foundations and vibration isolation mountings for various equipment, piping, and ductwork where used shall be as per requirements specified. Vibration isolators where used shall be of approved make.

Springs used for vibration isolation shall be single, open coil type and laterally stable, having a ratio of loaded height to mean coil diameter not greater than 1.25. To preclude possibility of spring coils "shortening" when motor starts or slows down, the springs shall be selected so that there remains when the spring is design loaded, a reserve deflection of between 25 and 30% of maximum deflection of free spring. When fully compressed, maximum stress in steel should not exceed yield stress of spring material. Springs shall be unhoused and held well clear of any part of suspended mass. Isolated system if supported on a flat slab type base shall be held clear of supporting structure or pad by the minimum distance thought necessary for efficient housekeeping or 1 inch. Lower end of each spring shall be supported on a rigid, square steel base plate sufficiently thick to withstand a bearing pressure of 427 kPa. This plate should be complete with 3 thickness of type W neoprene waffle pad between under inside of plate and supporting structure. A 16 gauge steel shim plate bonded to pad surfaces shall separate adjacent thicknesses. Spring base plate shall also be bounded to top layer of pad. Pad area should be chosen to suit hardness of neoprene. For 40 durometer neoprene, bearing pressure on supporting structure shall be 276-352 kPa when spring is design loaded. Waffle pads may have to be cut away in the middle of pads since pads shall have same overall dimensions as spring baseplate.

All pipe hangers must be insulated from the building by cork inserts between the hanger bar fixing and the connection to the structure. Details of the Contractor's method of achieving this shall be submitted to the Engineer for approval. All ceiling hung equipment having fans and motor as integral part of equipment shall have adequate vibration isolators.

All ceiling hung equipment having fans and motor as integral part of equipment shall have adequate vibration isolators.

Flexible duct connections, as specified elsewhere, shall be fitted wherever ducts

cross building expansion joints, at suction and discharge end of each air handling unit and fan wherever ducts are connected to such unit, and/or wherever shown on the drawings. Supply outlet of concealed ceiling-mounted fan coil unit shall also be connected to Fan-coil with flexible connection.

Details of all vibration isolators, flexible connections and bases shall be submitted to the Engineer for approval.

3-02 MOUNTING OF EQUIPMENT

3-02.1 Floor or Roof Mounted Equipment

All floor or roof mounted equipment shall be generally placed on at least 4 inch concrete housekeeping pads, unless otherwise indicated. The pads shall be constructed on 1 inch thick cork-sheet. Protective curbs shall be provided on all sides of the pad to protect the cork sheet edges. Special attention shall be given to the equipment at roof and intermediate floors and heavy equipment like Pumps and Chillers shall be mounted on spring isolators / inertia pads. The spring isolators shall preferably be supplied by equipment manufacturer and shall be from manufacturers specializing in manufacturing of vibration isolators. Manufacturer's recommendations for prevention of vibration and noise travel to the structure shall be adopted. The foundation details shall be subject to the approval of the Engineer.

3-02.2 Wall Mounted Equipment

All equipment installed through wall shall have 20 gauge galvanized sheet metal which shall remain in place permanently. Sleeves shall be packed with non combustible glass fiber insulation minimum of 1.5 lb/cu.ft density and sealed with sealant. Equipment installed through walls shall have supporting wall brackets.

3-02.3 Air Inlets/Outlets (NOT USED)

All wall grilles/EA-OA louvers shall be fixed to wooden frames and not to the ceiling material/wall masonry. Metallic frames may be used with metallic frame false ceilings. Wooden wall frames shall be grouted and finished by Contractor.

3-02.4 Ceiling-Hung Equipment

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

3-02.5 Floor Mounted Equipment

All floor-mounted equipment shall be resting directly on the raised floor pad (or supported from wall when approved by the Engineer).

3-03 VIBRATION ISOLATION

Vibration isolation bases shall be provided and installed under all pumps, to prevent the transmission of vibration to the building structure, as shown on Drawings.

Where fans and motors are integral parts of factory assembled air handling units and the fans and motors are not spring isolated from the air handling unit, the

entire unit shall be mounted on vibration isolators.

Inertia pads where indicated shall be reinforced cement concrete pad, at least 4 inch thick with 4 inch steel channel all around to protect concrete edges. Reinforcing rods shall be welded to channel frame.

Floor mounted Fans with belt drives shall be mounted on continuous rails with sliding base for motor adjustment and fan-rails shall be mounted on vibration isolators as specified above. When shown on Drawings, continuous rails shall be mounted on Inertia pads and pads shall be mounted on vibration isolators.

Flexible pipe connectors shall be installed in piping to prevent vibration and noise travel. Location and construction of these connectors are specified in Section on "Piping, Fittings, Valves and Specialties."

SECTION 4 - DUCTING AND SHEET METAL WORK

4-01 GENERAL

4-01.1 Ducting Material

All duct work shall be of galvanized steel sheet unless otherwise indicated on Drawings. Galvanized steel shall be of lock forming quality (LFQ) and shall have a galvanized coating of 8 oz total for both sides of one square meter of a sheet. The GI sheet shall conform to ASTM A-525 and ASTM-90.

Galvanized steel sheet shall be Cut Lengths coated by the Hot-Dip Method and manufactured per ISO Standard 3575-76 zinc coating designation Z-275.

4-01.2 Structural Steel

Structural Steel shall be M.S. members rolled from Pakistan Steel billets or equivalent conforming to ASTM designation A-36 standard specifications for structural steel.

4-01.3 Canvas Cloth

Canvas Cloth shall have specified weight with flame retardant quality.

4-01.4 Painting

All steel work in connection with supports for ductwork etc. exposed to the elements is to be painted with two coats of an approved rust preventive paint.

All exposed metal surface of hangers, brackets, etc. must be painted with two under-coats and two finishing coats of enamel paint of approved color. G.I. sheet is not to be painted. However, all uninsulated pipe work and valves are to be painted as stated above.

Identification bands shall be painted on uninsulated ducting, or on insulation at frequent intervals. Lettering shall be agreed with the Engineer.

All duct hangers in concealed locations shall be given one coat of black asphalt paint before being concealed.

4-02 DUCT CONSTRUCTION

All sheet metal duct work shall be of a standard construction and erected in a first class workmanlike manner. The duct work shall be constructed as per SMACNA Low Velocity Duct Construction Standards.

Where specified, duct work shall be provided with interior insulation. Ducts shall be straight and smooth on the side, with joints neatly finished. Where ducts are lined with interior insulation, the dimensions required shall be for the net free area after insulation is applied. Ducts shall be anchored securely to the structure in an approved manner and shall be installed so as to be completely free from vibration under all conditions of operation.

Sheet metal ducts shall be properly braced and reinforced with steel angles, or other structural members approved by the Engineer unless otherwise required,

the internal ends of all slip joints shall be installed in the direction of flow.

Finished work shall show no flaking or peeling within 1/4" of a cut edge. The construction and gauge of material, size and spacing of stiffeners for duct work shall be as follows:

Larger Dim. of Duct (in.)	Gauge (US)	Traverse Joint Type/Size (Inch)	Interm Bracing, Angle Size (Inch)	Max. Spacing between Traverse Joint &/or Interm Reinforcement
Thru 12	26	Drive slip/-	-	-
13 thru 18	24	Drive slip/-	-	
19 thru 30	24	Pocket lock/1	1x1x1/8	5
31 thru 42	22	Pocket lock/1	1x1x1/8	5
43 thru 54	22	Pocket lock/1-1/2	1-1/2x1-1/2x1/8	5
55 thru 60	20	Pocket lock/1-1/2	1-1/2x1-1/2x1/8	5
61 thru 84	20	Angled reinforced standing seam	1-1/2x1-1/2x1/8	5
85 thru 96	18	Angled reinforced standing seam	1-1/2x1-1/2x1/4	2.5
Over 96	18	Angled reinforced standing seam	1-1/2x1-1/2x1/4	2.5

Other types of Traverse joints allowed as per ASHRAE/ SMACNA Standards shall be acceptable, subject to Approval of Engineer, in places where pocket lock is not possible due to tight space.

All angles for bracing shall be painted with one coat of approved rust-inhibitive paint before fixing to duct.

All duct work in the finished areas shall be run parallel to the beams wherever possible. All outlet opening and open ends shall be kept closed with sheet metal caps during construction. Rectangular duct shall be constructed by breaking the corners and grooving the longitudinal seams. Elbows and transformation sections may be formed with Pittsburgh corner seams but complicated fittings shall be constructed with double seams. Angle bracing shall be of steel and shall be carried out on all four sides of the ducts. All bracing is to be in accordance with the current addition of the ASHRAE Hand Book/ SMACNA Standards.

4-03 ELBOWS

Ducts shall be built with curves and bends, where required, to affect an easy flow of air. Curved elbows shall have a centre line radius at least equal to 150% of the width of the duct unless otherwise indicated. All duct curves having an inside radius smaller than the width of the curve shall be equipped with approved single thickness vanes.

Vertical ducts shall have full size bends where horizontal branches are taken off

unless otherwise indicated, and/or approved.

Where square elbows are used in changing directions, approved and aerodynamically correct vanes as per latest SMACNA Duct Construction Standards shall be used.

These turning vanes must be free from vibration when the system is in operation.

4-04 HANGERS

Hangers and supports shall be fastened to the structure in a manner approved by the Engineer All fastening shall be such as to ensure permanent stability and to be capable of supporting at least three times the applied load.

Galvanized sheet metal ducts less than 20" in width (larger dimension) may be suspended by means of galvanized iron straps extended along the bottom of the duct to form a trapeze, only if hanger length above the duct is not more than 12".

All other ducts shall be suspended by means of iron bars securely fastened to the angle iron bracing or angle iron placed under the duct. Bars shall be fastened to bracing only on un-insulated ducts.

Bars shall be screwed to angles attached therein by sleeve/stud anchor screws and heavy iron washers from ceiling. Where horizontal ducting is fixed to walls, columns, supported from floor slabs, etc. angle iron frames are to be fabricated and fitted to support rectangular ductwork and associated equipment.

Vertical ducts are to be supported by steel angles bolted to at least two sides of the duct and on the complete circumference of the ducts where the larger duct dimension is greater than 24 inch.

Angle iron extensions shall be either grouted or bolted to the structure.

Hangers spacing and sizes shall be as follows.

Larger Duct Dim. (Inch)	Strap Size (Inch)	Bar Dia (Inch)	Bottom Angle Size (Inch)	Maximum Spacing (Feet)
Thru 12	1” x 22 ga.	3/8	1x1x1/8	8
14 thru 18	1” x 22 ga.	3/8	1-1/4x1-1/4x1/8	8
19 thru 30	1” x 18 ga.	3/8	1-1/2x1-1/2x1/8	8
31 thru 42	1” x 18 ga.	3/8	1-1/2x1-1/2x1/8	8
43 thru 54	1” x 16 ga	3/8	1-1/2x1-1/2x1/8	7
54 over	1” x 16 ga	½	2x2x1/4	6

Hanger rods shall be cross-braced whenever the length of rod above duct work is

more than 3 ft. to prevent swing of ducts.

All structural steel including hanger rods and angle iron shall be painted with one coat of approved rust- inhibitive paint before installing.

4-05 QUADRANTS FOR VOLUME DAMPERS

All dampers other than dampers behind registers and diffusers shall be fitted with substantial locking quadrants, mounted outside the duct in an accessible position. On insulated ducts the quadrants shall be fastened to bearing plates flush with the outside finish of the insulation.

4-06 DAMPERS

4-06.1 Volume Dampers (V.D)

A substantially constructed manual volume damper of the butterfly or multiple blade type as per latest SMACNA Duct Construction Standards shall be fitted where shown on the Drawings and at all branch entries or exits with main ducts for balancing purposes. Dampers shall have galvanized or painted steel interlocking blades of 8" maximum blade width. Blades shall be fabricated from 16 gauge steel with seamed edges and a maximum length of 4 ft. It should be noted that these dampers, shall be separate and independent from the dampers, hereinafter specified. Volume Dampers are not required where splitters Dampers, as specified hereinafter, are installed.

4-06.2 Splitter Dampers (S.D)

At each point of division in a supply trunk duct where a branch is taken off a trunk duct, an adjustable splitter or deflecting damper, one gauge heavier than the duct with operating rod and locking quadrant as above, shall be installed. These deflecting dampers shall be permanently set and locked in position after completion of the installation and adjustment with fans running.
Operating rods are to be full blade length extending through the duct to externally mounted bearing plates. Construction shall be as per latest SMACNA Duct Construction Standards.

4-06.3 Fire Dampers (F.D)

Fire dampers are installed as shown on the drawings. Frame shall be 4”x1”x1/8” galvanized steel channel with 16 gauge thick blades. Blades shall have an overlap of 1” and shall be fixed on self-lubricating bronze type bearings.

Dampers shall be complete with linkage rod and fusible link rated at 160 deg F. Damper construction shall meet NFPA 90-A requirements, and shall have the “hour” fire-rating not less than the fire rating of the plane where installed. Fire dampers shall be air tight when in close position.

4-07 FLEXIBLE DUCT CONNECTIONS

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

Flexible connections also be provided wherever ducts cross building expansion

joints.

Flexible connections shall be factory fabricated of imported origin, made from chemically impregnated canvas or other material 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 6" in length. Flexible connections shall not be painted or insulated. Samples of the material shall be presented to the Engineer for approval before installation.

4-08 ACCESS DOORS AND PANELS

Wherever necessary, suitable access openings, doors and frames to permit inspection, operation and maintenance of all filters, controls, dampers, bearings or other apparatus shall be provided in ducting. Doors shall be of double construction, of not lighter than 20 gauge metal sheet and shall have sponge rubber gaskets around their entire perimeter. On insulated duct work the space between the inner and outer door sheets shall be insulated as specified for the ductwork. All access doors in sheet metal shall have air tight seal, shall be hung on heavy flat hinges and shall be secured in the closed position by means of wing type nuts and screws or coin operated catches.

4-09 SLEEVES

Where ducts pass through walls, partitions, or floors, wooden sleeves shall be provided by the Contractor and these sleeves shall remain in place permanently. Sleeves shall be packed with non-combustible glass- fiber insulation, minimum of 1.5 lbs/cu.ft. Density and sealed with sealant.

4-10 TEST WELLS

The Contractor shall provide test wells for measurement of air velocity and static pressure for balancing purpose. These wells made up of a brass nipple with screwed caps are to be fixed into the duct or casing on the downstream sides of each fan, filter, AHU, FCU and branch volume damper in each branch supply duct, and on upstream side of branch volume damper in each branch return. The design of test well shall be subject to Engineer's approval.

4-11 FLEXIBLE ROUND INSULATED DUCT

This shall be round insulated duct, factory made with 1 1/2” thick fiberglass blanket wound round a coated helix wire coil and fiberglass inner mesh liner. Thermal conductance shall not be more than 0.27 btu/hr-sft-deg F at 75 ^{o}F and shall meet the fire safety requirement of UL 181 Class 1 air duct. Flexible round duct shall be as manufactured by certain Teed (USA) or approved equal.

4-12 BREACHING/FLUE STACK

The contractor shall provide welded steel breaching/stack for size and configuration as required and as per recommendations of the manufacturer. Fabrication shall be by welding using no less than 3.4 mm thick plate conforming to ASTM A 36 or A 283. Structural angle flanges for breaching and boiler connection shall be provided. Stack shall be terminated as shown on drawings and at least five (5) feet above cooling tower fan level and shall be provided with weather cap on top.

SECTION 5 - PIPING, FITTINGS, VALVES & SPECIALTIES

5-01 GENERAL

5-01.1 Each part of the piping system shall be complete in all details and provided with all control valves and accessories necessary for satisfactory operation. Valves from local manufacturer shall have additional warranty of three (03) years with complete replacement of parts or whole valves.

5.01.2 The Bidding Drawings indicate generally the routes of all main piping and sizes are shown on Drawings for quotation purpose. The Engineer reserves the right to change the runs and sizing of piping to accommodate conditions during construction.

5.01.3 All piping shall comply with the requirements of the ANSI B31.1 Code for Power Piping. The other pressure vessels shall comply with ASME Boiler and Pressure Vessel Code Section VIII.

5-01.4 All piping shall be grouped wherever practicable and shall be erected to present a neat appearance. Pipes shall be parallel to each other and parallel or at right angles to structural members of the building and shall give maximum possible headroom.

5-01.5 All pipe drops shall be truly vertical. No joints shall be formed in the thickness of walls, floors or ceilings. The Contractor is responsible for ascertaining the thickness of plaster and other wall finishes, skirting heights, cill lengths and floor finishes.

5-01.6 Piping shall not pass in front of doorways or windows and shall be generally arranged so that it is at least 3" above finished floor level and at least 1" from finished wall faces. Sufficient space is to be allowed for accessibility for servicing.

5-01.7 Piping shall be pitched for proper circulation and drainage. Run outs shall be graded in such a manner as to prevent air traps being formed within them when the mains expand or contract. Automatic or manual vents are to be provided at high points. All automatic vents shall be piped to suitable drains.

5-01.8 All drain piping shall pitch down in direction of flow. All drains from items such as drip pans of air conditioners and air handlers shall be piped to spill over an open sight drain, floor drain, roof gutter or other acceptable discharge points and shall be terminated with a plain end unthreaded G.I. Pipe, 6" above the drainage. Drain piping from all air handling units except fan coils shall have 3” water seal unless indicated otherwise.

5-01.9 All low points of the system must be fitted with drain valves to permit the complete drainage of the system. Bottoms of all risers must have dirt pocket the size of the riser of at least 12" long with a drain valve fitted. All water piping to equipment and valves shall be connected with either flanges or unions for dismantling and removal. All piping shall be reamed after cutting to remove all burrs.

5-01.10 Approved pipe fittings shall be used and bending of pipes will not normally be allowed except for black steel pipe 2" diameter and under which shall be permitted where space conditions allow for a bending radius of at least 10 times the diameter of the pipe. A hydraulic pipe bender shall be used to bend all pipes.

Bends showing kinks, wrinkles, or other malformations, will not be acceptable.

5-01.11 Piping shall not be installed passing through ductwork or directly under electric light fixtures, unless indicated otherwise.

5-01.12 In placing pipes through sleeves, near walls, partitions or in chases, care must be taken to provide sufficient space for pipe fittings and covering.

5-01.13 Where pipes are held in vices, as when screwing, care shall be taken to ensure that the pipe surface is not damaged. Any pipe work so damaged shall not be fitted.

5-01.14 All pipes stored on site shall be kept clean and off the ground and where possible stored under cover. Pipes corroded beyond normal "stock-rust" condition shall not be used. Special care should be taken to prevent dirt entering into pipes. The Contractor shall note that a valve fitted to the open ends of a disconnected pipe is not considered satisfactory to prevent entry of foreign matter. Screwed iron caps or plugs or plastic covers shall be used to seal pipe ends. Wood, rag, paper or other inadequate plugs will not be permitted.

5-01.15 Before connecting up to return mains, the system of piping must be blown and flushed out. After flushing, all strainers shall be opened and baskets cleaned.

5-01.16 Liberal allowance shall be made for expansion and contraction of pipes by means of changes in direction or by the inclusion of expansion joints in the piping system. Flexible connections shall also be provided whenever piping cross building expansion joints. Not less than 2 Pipe Guides as approved by the Engineer shall be used on both sides of expansion joint/loop.

5-01.17 All steel work in connection with supports for pipes exposed to the elements is to be painted with two coats of an approved rust preventive paint.

All exposed metal surface of hangers, brackets, etc. must be painted with two under-coats and two finishing coats of enamel paint of approved color. G.I. sheet is not to be painted. However, all un-insulated pipe work and valves are to be painted as stated above.

Identification bands shall be painted on piping or on insulation at frequent intervals. Lettering shall be agreed with the Engineer.

All steel pipes supplied when delivered at site, shall have factory manufacturing date not older than two (02) month for local pipes and three (03) months for imported pipes.

All pipe hangers in concealed locations shall be given one coat of black asphalt paint before being concealed.

5-02 PIPING, FITTINGS & ACCESSORIES

5-02.1 Pipe Schedule

Sr. No.	Service	Size	Specifications
(a)	Seamless Steel		
(i)	Chilled/hot &	All	Schedule 40 black seamless

	condenser water	sizes	steel, ASTM A 106 Grade B or equivalent
(ii)	Chemical Feed, natural Gas and high speed diesel oil	All sizes	Schedule 40 black seamless steel, ASTM A 106 Grade B or equivalent
(b)	Cooling Coil condensate drain	All sizes	UPVC, Class D
(c)	Make-up water, and drain	All sizes	Galvanized steel, Light Quality BSS 1387, UPVC, Class D
(d)	Piping for auto vents discharge	1/4”	Copper, Type K

5-02.2 FITTINGS

5-02.2.1 General

Fittings shall conform to following Schedule; in piping 6" and larger, “stub-in” type connections will be permitted when branch line is at least four pipe sizes smaller than main run.

5-02.2.2 Fittings Schedule

Sr. No.	Service	Size	Specifications
(a)	Seamless Steel Piping		
(i)	Chilled/hot & condenser water	2.5" & smaller	150 lb black steel threaded fittings, Malleable iron .
(ii)	Chilled/hot and condenser water	3" & larger	Schedule 40 black welded steel, welding fittings to ANSI B 16.9
(iii)	Chemical feed, natural gas, and diesel oil	All sizes	150 lb black cast iron screwed fittings to ANSI B 16.4
(b)	Cooling coil condensate drain	All sizes	uPVC, Class D
(c)	Make-up water/drain	All sizes	uPVC, Class D

5-02.3 UNIONS AND FLANGES

5-02.3.1 General

Unions and flanges shall be provided where indicated and/or required for proper installation and maintenance of the system. They shall conform to the respective schedule given hereunder.

Flanges shall have bolt holes drilled and raised faced and fitted with black mild steel bolts, nuts and washers.

If equipment has different flanges to the type specified then mating flanges must

be supplied of the same rating to connect to this equipment.

Extend flange bolts through nut at least four full threads when made up.

5-02.3.2 Union Schedule

Sr. No.	Services	Size	Description
a)	All services using black steel pipe	All sizes	150 lb malleable iron screwed, conical seat type
b)	All services using galvanized steel pipe	All sizes	150 lb malleable iron, galvanized screwed, conical seat type

5-02.3.3 Flange Schedule

Sr. No.	Services	Size	Description
a)	Services using black steel pipe	All sizes	ANSI 150 lb weld-neck or slip-on as indicated or required.
b)	All services using galvanized steel pipe	All sizes	ANSI 125 lb galvanized cast iron screwed pipe

5-02.4 Pipe Supports and Anchors

All supports for steel piping shall be ferrous. Brackets or supports shall be set out so that they do not obstruct the access to valves, flanges or other fittings requiring maintenance.

All pipework shall be supported by means of approved clips or hangers at centres as specified. In the event of two or more pipes being carried by a single support the spacing shall be for the shorter interval.

All vertical drops shall be supported so as to prevent sagging or swinging. Unless otherwise indicated, pipe hangers are to be spaced as follows:

Nominal Pipe Size (Inch)	Maximum Span (Feet)	Minimum Rod Dia (Inch)
1 and smaller	6	3/8
1 ¼ - 1 ½	8	3/8
2 – 2 ½	10	3/8
3	10	1/2
4	12	1/2
5	14	5/8
6	16	5/8
8	20	7/8
10	20	7/8
12	20	7/8
14	20	1
18	20	1

Piping at all equipment, and control valves shall be supported to prevent strains or distortions in the connected equipment, valves and control valves. Piping shall be supported to allow for removal of equipment valves and accessories with a

minimum of dismantling and without requiring additional supports after these items are removed.

All channels, angles, plates, clamps etc. necessary for the fastening hangers shall be furnished by Contractor. All hangers shall be properly sized for the pipe to be supported. Oversized hangers shall not be permitted, without Engineer's approval.

All hangers shall be provided with lock nuts and have provisions for vertical adjustment of pipes.

Individual horizontal piping shall be supported by hangers consisting of malleable split rings with malleable iron sockets, or steel clevis type hangers, or roller hangers as directed by the Engineer.
Pipe stands with base flanges and adjustable type yokes shall be used for pipes supported from the floor.

Vertical piping shall have heavy wrought iron or steel clamps securely bolted on the piping with the end extensions bearing on the structure of the building.

Piping shall be anchored where required to localize expansion to prevent undue strain on piping and branches. Anchors shall be entirely separate from hangers and shall be heavy forged or welded construction of approved design.

Hangers for cold piping shall have hardwood inserts or high density insulation capable of withstanding the compression and allowing the hanger to support the pipe without any metal contact.

Upper ends of iron rods shall be welded to angles attached to ceiling (concrete slab) by anchor screws and heavy iron washers.

Stud Anchors shall be used for 6” or above piping.

5-02.5 Pipe Sleeves

All pipe penetrating through walls, partitions and slabs shall have sleeves having an internal diameter at least 1" larger than the outside diameter of the pipe or of the insulation passing through the sleeves.
Pipes passing through interior masonry or concrete floor shall be provided with sleeves of galvanized standard wrought steel pipe flush with walls and ceilings and extending 1" beyond external surface of wall or above finished floor.

On the exposed pipes, passing through floors, wall, partitions plaster furrings, split type nickel plated circular steel plates, 3" larger in outside diameter than the outside diameter of the pipe or pipe covering, shall be provided.

5-02.6 Flashing Sleeves

Flashing sleeves are to be provided where pipes pass through water proof membranes. Flashing sleeves details are to be submitted to the Engineer for approval but generally they shall be provided with an integral flange set into the membrane. The associated pipe shall also have a flange and sealed with approved mastic.

5-03 VALVES AND SPECIALITIES

5-03.1 General

Valve and piping specialties shown on drawing are only schematic and all required valves and specialties are not necessarily shown on drawings.

The Contractor shall furnish all shut-off valves, check valves, drain cocks, dirt traps, automatic vents, manual vents, relief valves, strainers and other specialties as are required for proper operation of the whole system.

All valves smaller than 2" shall be of bronze body with threaded connection.

All valves of sizes of 2" and larger upto 10" shall have cast iron body and renewable bronze seal rings, bronze spindles and self packing feature so that they can be packed while open and under pressure.

All valves larger than 10" shall be of ductile iron body.

All valves shall be of design and construction to conform to the 1.5 time the maximum design pressure (minimum 150 psi at 250 ^{O}F) of the system, but not less than PN-16. All valves shall be provided with epoxy/ powder coating as per standards. The valve rings/ cope shall be made of Teflon.

5-03.2 Plug Valves

Plug valves shall be used for drain cocks and stop cocks at air vents.

5-03.3 Pressure Reducing Valves

Pressure reducing valves shall be used where shown on the drawings.

5-03.4 Balancing Valves

Circuit setter type valves as specified hereunder shall be used for balancing purpose where shown on drawings.

Globe valves shall be used for balancing purpose where shown on drawings.

Shut-off valves shall be installed on both sides of all equipment. Balancing valves shall be installed where required for flow balancing. Make of valves shall be subject to Engineer's approval

5-03.5 Gate Valves

Gate valves shall be used for shut-off purposes. All valves shall be designed for packing under pressure when fully open.

5-03.6 Relief Valves

Relief valves shall be provided for over-pressure protection. Valves shall have flanged-end connections except for valves 1" and smaller.

5-03.7 Globe Valves

Each globe valve shall be constructed with internal seal to prevent leakage around rotating elements

5-03.8 Circuit Setter Type Valves

These valves shall be calibrated and with bronze disc valve equipped with readout valves. Each readout valve shall be fitted with an integral check valve designed to protect the user from being wetted when setting up to monitor flow. An integral pointer shall register degree of valve opening. Each balance valve to be constructed with internal seals to prevent leakage around rotating element.

The Contractor shall arrange for the Read-out kit specified by the manufacturer for balancing flow through the valves without any additional cost.

5-03.9 Non-Return/Check Valves

Non-return/check valves shall be non-slam check valves, spring loaded with stainless steel torsion spring. The valves body shall be lapped bronze seat, and spring loaded twin balanced flappers of bronze. The flappers shall open and close at low differential pressures to prevent damaging effects of water hammer created on pump shut-down.

5-03.10 Strainers

Approved strainers shall be fitted in the suction line of pumps, at make-up connections and at each automatic control valve of all apparatus of an automatic character whose proper functioning would be interfered by dirt on the seat, or by scoring of the seat. All strainers shall be pressure tested at works.

All strainers shall be cast iron or bronze bodies of ample strength for the pressure to which they shall be subjected and with suitable flanges or tapings to connect with the piping they serve.

Strainer basket screens shall be stainless steel and shall be of ample strength to prevent collapsing the basket under shock loading. Perforations shall be in accordance with the following table:

Pipe Size	**Perforation Size (inch)**	**Number of Perforations per sq. in.**
All Sizes	3/64	225

Valve dirt blow-out connection suitably piped to the nearest floor drain.

5-03.11 Air Vents

Wherever possible, all water pipe work systems shall have manual venting at all high points in the system. Where this is not possible an automatic air vent shall be fitted and connected to the nearest drain. Air vents shall be of the flat type, and of

appropriate sizes and working pressures. They shall be fitted with a suitably sized gate type lock shield valve. Manual vents shall be fitted with hose-nozzles.

5-03.12 Flexible Pipe Connectors

Flexible connectors shall be provided wherever pipes cross building expansion joints, at suction and discharge side of each pump and at connections to chillers, and/or wherever shown on the Drawings. 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.

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.

5-03.13 THERMAL EXPANSION JOINTS

Thermal expansion joint bellows shall be fully annealed type 321 stainless steel sheet stock rolled into a tube and seam welded with latest technology in forming the corrugations. The bellows shall be designed to take linear thermal expansion as well as axial load.

The end connections will be fixed flanged type and shall be of stainless steel conforming to ANSI dimensions welded directly to the integral ends of the bellows.

The thermal expansion bellows shall be designed to absorb the thermal expansion of at least +50 mm and working pressure of 16 bars.

5-03.13 ELECTROMAGNETIC WATER FLOW METER/ MAGMETER

The magmeter shall be provided as per latest international standard capable to install in the main line and capable to read flow rate directly in GPM and display in Built on LED installed above the meter. The magmeter shall be capable to integrate with BMS and shall be provided with open protocol.

SECTION 6 – INSULATION

6-01 GENERAL

6-01.1 The Contractor shall provide insulation for the services and equipment specified hereafter. Insulation shall be as per following Insulation Schedule.

6-01.2 Insulation material shall be complete with vapour barrier protection covering and jacketing (where specified), adhesives, insulation tape, duct sealer and/or sealing tape, fastening material, and jacketing for outdoor ducting and piping.

6-01.3 Identification bands shall be painted on insulation at frequent intervals. Lettering shall be agreed with the Engineer.

All exposed insulation in the plant room is to be painted to approve colors with one undercoat and one finishing coat of enamel paint. All steel pipe work and other steel equipment specified to be insulated shall be thoroughly wire brushed to the satisfaction of the Engineer and painted with one coat black cold asphalt paint before insulation is applied.

6-02 Insulation Schedule

Sr. No.	Services	Thick-ness (Inch)	Insulation Type	Vapour Barrier	Protection
a)	Indoor supply/return duct				
i)	Concealed to vision outdoor-air duct passing through conditioned space	1	Glass fiber blanket	Reinforced aluminum foil	8-Oz canvas
ii)	Exposed to vision and plant rooms	2	Glass fiber blanket	Reinforced aluminum foil	4-Oz canvas with water proof paint. GI/Al. sheet metal jacketing.
iii)	AHU rooms	2	Glass fiber blanket	Reinforced aluminum foil	4-Oz canvas with water proof paint.
b)	Supply ducts, up to 10 feet from fan discharge and sheet metal air plenums	1	Acoustic liner applied inside with outside insulation as Item 6-02 (a)	Same as 6.02 (a)	
c)	Chilled/hot water piping, fitting valves &				

	specialties				
i)	Indoor	See 6-02(g)	Glass fiber blanket	Reinforced aluminum foil	4-Oz canvas
ii)	AHU rooms	See 6-02(g)	Glass fiber blanket	Reinforced aluminum foil	4-Oz canvas with water proof paint.
iii)	Central plant room and outdoor	See 6-02(g)	Glass fiber blanket	Reinforced aluminum foil	4-Oz canvas with water proof paint. GI/Al. Sheet metal jacketing.
d)	Cooling coil condensate drain piping	2	Closed Cell Foam	Reinforced aluminum foil	--
e)	Chiller	As per recommendation of chiller-heater manufacturer			
f)	Expansion tank and air separator	1	Glass fiber blanket	Reinforced aluminum foil	1/2” thick 8 Oz canvas water proof paint metal jacketing.
g)	Insulation thickness if not specified above shall be as under:				
i)	Water pipe Up to 2” 2-1/2” to 5” 6 and above	 1” thick 2” thick for Glass Fiber 2-1/2” thick for Glass Fiber	--	--	--
ii)	Valves and other specialties	Thickness shall be same as applied to connected pies.			--
h)	Flue stack / breaching	2	Mineral fiber	--	1” thick reinforced magnesia further with G.I sheet metal jacket.

6-03 INSULATION MATERIALS

6-03.1 Duct Insulation

Insulation material for ducts and sheet metal air plenums shall be flexible glass fiber, 1.0 lbs/cu.ft. Density and maximum conductivity of 0.27 Btu/hr.sq.ft./inch at 75 deg F.

6-03.2 Piping Insulation

Piping insulation shall be sectional glass fiber as specified above in Insulation Schedule, bounded to conform to the pipe. All glass fiber pipe insulation shall have a density at least 4 lb/cu.ft. and maximum conductivity of 0.27 Btu/hr.sq.ft.^{o}F/inch at 75 Deg F.

6-03.3 Vapour Barrier for Duct and Pipe Insulation

Vapour barrier when specified shall be factory applied flame retardant reinforced aluminum foil, 0.02 mils thick.

6-03.4 Acoustic Liner Material

Acoustic liner shall be 1.5 lbs/cu.ft. Density fiber-glass with neoprene scrim on inside surface and thermal conductivity value shall not exceeding 0.27 Btu/hr.sft ^{o}F /inch at 75 Deg F. Material shall conform to TIMA Standard AHC-101-1975 with latest revisions.

6-03.5 Cooling Coil Condensate Pipe Insulation

Shall be 1" thick pipe insulation as mentioned above with aluminum foil self adhesive tape 3" wide.

6-03.6 Chiller-Heater Insulation shall be as per recommendation of Chiller-Heater Manufacturer.

6-03.7 Expansion Tank and Air Separator Insulation

Shall be glass fiber, at least 3 lbs/cu.ft. density or closed cell foam type at least 3.5 lbu/cu.ft.

6.03.8 Insulation for Breaching/Flue Stack

Shall be spun mineral fiber with thermal conductivity not exceeding 0.56 BTU/(hr)(Sq.ft.)(F)/inch at 600 deg.F. Insulation shall have wire netting jacket on one side and copper clad or brass wire mesh jacket on the other side.

6-03.9 Insulation Protection Material and Accessories

6-03.9.1 Canvas

4 Oz or 8 Oz per square yard as specified in Insulation Schedule.

6-03.9.2 Jacket

24 gauge (US) galvanized steel sheet or aluminum sheet.

6-03.9.3 Water & Rat Proof Paint

As approved by the Engineer.

6-03.9.4 Wire Netting

1" hexagonal mesh, 20 gauge (US), galvanized.

6-03.9.5 Metal Lathe

Expanded metal lathe with 1/2 inch diamond mesh.

6-03.9.6 Banding

1/2" x 1/48" galvanized steel or aluminum bands.

6-03.9.7 Insulation Tape

Insulation tape for joints shall be of aluminum foil type, 2 inch wide, equivalent to Scotch No.473.

6-03.9.8 Adhesive

Adhesive for thermal insulation shall comply with ASTM Standard C 916-79 or equivalent. Adhesive for acoustic liner shall comply TIMA Standard AHC-101-1975 or equivalent.

6-03.9.9 Duct Sealer

Sealer for duct joints shall be butyl rubber caulking, weather proof and water resistant, conforming to U.S. Federal Specification TT-S-001657 Type 1, as manufactured by Woodmont Products, INC, USA, or approved equal.

6-03.9.10 Duct Sealing Tape

Duct sealing tape shall be 3 inch wide self-adhesive vinyl cloth tape.

6-04 INSULATION APPLICATION

6-04.1 General

All Thermal and acoustic insulating materials shall be installed as specified hereinafter.

Insulation shall be installed in a smooth, clean, workmanlike manner and joints shall be tight and finished smooth.

All surfaces to be insulated shall be dry and free from loose scale, dirt, oil or water when insulation is applied. Insulation shall be applied in such a manner that there will be no air circulation within the insulation or between the insulation and the surface to which it is applied.

Surface imperfections in the insulation such as clipped edges, small joints or cracks and small voids, or holes not over 1 inch square shall be filled with like

insulating material.

Where a vapour barrier is fixed on site it shall be fixed in such a manner as to obviate the possibility of moisture penetration. It shall be fixed where required by means of an approved type bituminous compound or approved equal for tightness.

Insulation for all services shall only be applied until after testing and approval for tightness obtained from the Engineer, unless otherwise instructed in writing by the Engineer.

Insulation for all services shall be continued through sleeves. The insulation on exposed risers shall extend through the floor. Where insulated pipes are indicated on drawings as embedded in the thickness of walls, the insulation thickness may be reduced to 1 inch only.

Insulation is to be applied where indicated on the drawings or called for in these specifications.

6-04.2 Duct Insulation

Before applying insulation, either sealing tape or duct sealer shall be applied on all corners of traverse joints for air tightness.

The insulation shall be fixed on ducts with a suitable adhesive as specified. Adhesive shall be applied on at least 75% surface area. In addition to the fixing by adhesives, insulation on the underside of ducts exceeding 18 inch width must have mechanical fasteners of an approved pattern to prevent insulation sagging, or alternatively bands as specified above shall be used at intervals not exceeding 4 feet.

All joints on the insulation shall be sealed with 2 inch aluminum foil tape. The tape shall only be fixed to the vapour seal and not to the bare insulation and, therefore, joints in the insulation shall not occur longitudinally at corners of ducts. If it is unavoidable to have joints at longitudinal corners then the insulation must be cut back and the vapour seal folded over the bare edge of the insulation so that the tape adheres only to the vapour seal.

6-04.3 Duct Insulation Protection

Indoor Exposed Duct: Insulation shall be covered over the vapour seal with a single layer of canvas with generous overlaps. The canvas shall be fixed with an approved adhesive.

6-04.4 Piping and Accessories Insulation

All pipes, fittings, valves and equipment requiring insulation in accordance with Insulation Schedule, shall be insulated with material specified under "Insulation Materials".

Longitudinal joints of pipe insulation shall be sealed with an overlap of vapour seal firmly fixed with an approved/specified adhesive.

Circumferential joints shall be sealed with insulation tape.

6-04.5 Pipe Insulation Protection

(a) Indoor Pipe Exposed

This finishing shall be used where the insulation is exposed to view.

The 8 Oz canvas wrapped around insulation shall be wrapped and fixed with approved adhesive.

The canvas shall be finished with three coats of Benjamin Foster's “Selfas'' or other equal and approved.

(b) Outdoor Exposed Piping and Plant room piping

The insulation shall be covered with stout gauge, G.I. sheet or aluminum metal jacketing. This finish shall be over the 8 Oz canvas applied as specified in (a) above.

6-04.6 Insulation for Equipment having Renewable Heads

Insulation which is applied to equipment having renewable heads and/or access plates shall be applied in a manner which will permit easy removal and replacement of the insulation. In general this shall be accomplished by encasing the insulation in sheet metal boxes which shall be bolted together.

6-04.7 Condensate Drain Piping

Self adhesive pipe insulation tape, as specified above, shall be spiral-wrapped around pipe, with 50% overlap.

6-04.8 Expansion Tank Insulation/Air Separators Insulation

Glass fiber insulation fixed with adhesive shall be finished with canvas jacket applied and saturated with adhesive. Insulation shall be further held with metal bands. Canvas shall be covered with approved gauge G.I./Aluminum sheet metal jacketing.

6-04.10 Insulation for Breaching/Flue Stack

Breaching and flue ducts shall be protected with one layer of magnesia, reinforced with wire netting. Outdoor flue ducts shall have G.I. sheet jacketing over magnesia.

6-05 PIPE INSULATION PROTECTION SHIELDS

Insulation shields shall be used at all hangers supporting insulated pipe to protect the insulation wherever fiberglass pipe insulation is installed. Where hangers and insulation shields are installed the insulation shields shall bear only an insulation material which is of such density that it will not compress, crush or deform. Density at these points shall not be less than 6 lb/cu.ft. Thickness and k- factor shall be at least equal to general run of insulation. Insulation manufacturer shall confirm suitability of insulation support without any visible compression.

Shields shall consist of 10 gauge galvanized steel plate. The plate shall be curved

to fit the contour of the insulation and shall cover the lower 180 degree of the surface. Shields shall be secured to the insulation by means of galvanized steel or aluminum bands, and shall not be less than 10" in length.

SECTION 7 - INSTRUMENTS AND GAUGES

7-01 GENERAL

All necessary gauges, and pipeline thermometers and other indicating and measuring instruments as required, specified and shown shall be furnished and installed by the Contractor. All gauges and thermometers shall have labels indicating their function.

Instruments shall include but not limited to:

Pressure gauges.
Thermometers for water piping
Gas flow meter
Testing and Maintenance instruments

These instruments shall be installed as shown on Drawings. Portable testing and maintenance instruments shall be supplied in carrying cases.

7-02 PRESSURE GAUGES

Pressure gauges shall be of the Bourdon tube type.
Working parts shall be of corrosion resisting metals.

Dial diameter shall be 4.5" and shall permit easy reading from floor with black numerals on white background.

Range shall place operating pressure at or near the middle of scale. Dial face shall be calibrated in psi and KPa in suitable increments with a range not less than one and half times the maximum operating pressure. Pressure gauges shall be complete with shut- off cock and necessary tubing with socket adapter.

When gauges are mounted on a panel board they shall be flush mounted.

7-03 THERMOMETERS

Thermometers for water line shall be mercury in steel with metal guard steel bulb and separable sockets screwed 3/4" dia., 9” length. Thermometers shall be complete with well for piping.

Calibrations shall be in degrees Fahrenheit with suitable increments. Range shall place operating temperature at or near the middle of scale. Range shall not be less than one and half times the maximum operating temperature.

7-04 GAS FLOW METER

Gas flow meter shall be of digital direct display type suitable to be operated in gas line of the project. It shall be completed in all respect with all accessories.
Calibration shall be directly readable from LCD screen.

7-05 TESTING AND MAINTENANCE INSTRUMENTS

The Contractor shall supply following testing and maintenance instruments

1. 1 No. Tachometer
2. 2 Nos. Insertion type duct thermometer
3. 1 No. Dry bulb and wet bulb measuring Sling thermometer
4. 1 No. Clamp-on Ammeter
5. 1 No. Digital Sound level measuring meter

Details of these instruments with catalogues shall be submitted to the Engineer for approval.

SECTION 8 - PAINTING & EQUIPMENT IDENTIFICATION

8-01 GENERAL

All material and labour for painting and identification of services shall be provided by the Contractor, as specified hereunder:

8-02 PAINTING

All steel work in connection with supports for pipes ductwork etc. exposed to the elements is to be painted with two coats of an approved rust preventive paint.

All exposed metal surface of hangers, brackets, etc. must be painted with two under-coats and two finishing coats of enamel paint of approved colour. G.I. sheet is not to be painted. However, all un insulated pipe work and valves are to be painted as stated above.

All machinery and equipment which have been painted in factory to the satisfaction of the Engineer shall have a finishing coat of paint before Final Acceptance if the factory paint is damaged during transportation, storage or installation.

Identification bands shall be painted on un insulated ducting, piping or on insulation at frequent intervals. Lettering shall be agreed with the Engineer

All exposed insulation in the plant room is to be painted to approved colours with one undercoat and one finishing coat of enamel paint. All steel pipe work and other steel equipment specified to be insulated shall be thoroughly wire brushed to the satisfaction of the Engineer and painted with one coat black cold asphalt paint before insulation is applied.

Internal surfaces of grilles, diffusers and register boxes and connections visible to occupants of rooms, shall be painted by Air Distribution Contractor with two coats of dull black paint or other colour as directed by the Engineer.

All pipe and duct hangers in concealed locations shall be given one coat of black asphalt paint before being concealed.

All steel pipe, cradles, vibration isolation rails that will be covered, partially covered, set in cement or fill, or not accessible when the installation is completed, shall be given two coats of black asphalt paint.

8-03 MANUFACTURER'S NAMEPLATES

Each unit or equipment shall be identified by a permanently attached nameplate made of brass or other corrosion resistant material. Plates shall not be less in size than 1.5 inch x 3 inch Plates shall bear information pertaining to unit as follows:

System and unit designation from Schedule of Equipment.
Manufacturer's name and address (only distributor's or agent's name and address will not be accepted).
Rated capacity.
Temperature, pressure or other limitations.
Electrical Data

8-04 VALVE TAGS, CHARTS AND NAMEPLATES

Valve Tags, dampers and controls shall be designated by distinguishing numbers in English on the charts or diagrams. The Contractor shall provide stamped brass tags for all designated items with numbers corresponding to those on the charts.

The tags shall be not less in size than 1-1/2 inch in diameter with depressed black numbers of ½ inch height.

The Contractor shall provide separate lists designating the location and function of each valve, dampers and control.

The charts, diagrams and lists shall be of sizes, type and character as approved.

SECTION 9- INSPECTION TESTING AND COMMISSIONING

9-01 GENERAL

9-01.1 The whole of the works supplied under this Contract shall be subject to inspection and tests by the Employer and/or Engineer should he so require, during manufacturing erection and after completion. The inspection and tests shall include, but not be limited to, the requirements of this Section of the Specifications.

9-01.2 For this purpose the Engineer shall, at all reasonable times, be allowed free and ready access to the Contractor's shop and the shops of his suppliers for the purpose of inspecting the specified equipment components, or any other parts, and obtaining information as to the progress of the work. Failure on the part of the Engineer at this or any other time, to discover or reject materials or work which do not meet specified requirements shall not be deemed an acceptance thereof nor a waiver of defects therein.

9-01.3 Specific tests required by the various items of the Plant, Parts, materials and equipment shall be treated in accordance with the specifications of the corresponding clauses of the Specifications.

9-01.4 The Contractor shall submit to the Engineer, one month prior to the date of commencement of the balancing and performance tests, six (06) copies of the complete test procedure. The procedure, method and points of measurement as well as the method of calculation shall be approved by the Engineer before any test is carried. Six (06) copies of the test results shall be furnished to the Engineer for his approval.

9-01.5 The Contractor shall supply all necessary testing and balancing instruments, which shall include, (but not limited to) the instruments listed in Section 8, INSTRUMENTS AND GAUGES, and carryout any test of any kind on a piece of equipment, apparatus part of system or on a complete system if the Engineer requests such a test for determining specified or guaranteed data, as given in the Specifications or in the Schedule of Equipment. Necessary skilled staff shall be provided by Contractor.

9-01.6 Any damage resulting from the test shall be repaired and/or damaged material replaced with intimation to the Engineer, all to the satisfaction of the Engineer, and at no extra cost to the Employer. Skilled staff shall again be provided by the Contractor.

9-01.7 In the event of any repair or any adjustment having to be made, other than normal running adjustment, the tests shall be void and shall be recommenced after the adjustment or repairs have been completed.

9-01.8 All testing, balancing and final adjustment shall be in accordance with the provision of the applicable ASHRAE Standards, or other approved relevant standards.

9-01.9 The Contractor shall test a piece of equipment, apparatus, parts of system or a complete system in accordance with method and Schedule of Tests provided by the Engineer to determine Specified or Guaranteed data, given in the Specifications, Schedule of Equipment and Contractor's Data Sheets.

9-01.10 The contractor shall be responsible for carrying out tests on the material/equipment/installation furnished by him.

9-02 PRELIMINARY INSPECTION & TESTS

9-02.1 General

All equipment shall be inspected and tested to determine the completeness and general conformance to specified requirements, when operated independent of overall HVAC System, for noise, vibration, and electrical data.

9-02.2 Piping System

Pressure tests on part or whole of piping network shall be applied only before connection of equipment and appliances.
In no case shall piping, equipment or appliances be subjected to the pressure exceeding their rating.

Tests shall be completed and approved before any insulation is applied on pipes, valves and fittings, and before these are concealed. Tests shall be performed in the presence of and to the satisfaction of the Engineer or his representative. Any leaks or defects discovered by the tests shall be repaired and the system retested as above, all at no additional cost to the Employer.

The prescribed pressure shall be maintained for four (04) hours.

9-02.3 Ductwork

Inspection on ductwork shall be carried out by Contractor's supervisor in the presence of Engineer's representative to the satisfaction of the Engineer.

All joints in ducts and at outlets shall be physically inspected for air leakage. All dampers shall be tested for proper operation.

Ducts, plenums and casing shall be inspected and made substantially air tight before covering with insulation or concealing in the masonry. The terms substantially airtight shall be construed to mean that no air leakage will be noticeable through the senses of feeling or hearing.

9-02.4 Equipment

All HVAC equipment shall be inspected for visible damage, operation of moving parts, noise and vibration. Tests shall be carried out with readings of RPM, ampere, voltage, etc. to verify the name plate data.

9-03 BALANCING AND COMMISSIONING

9-03.1 Air and Water Balancing

All air handling and ventilating equipment, ductwork air inlet and outlets, air volume control dampers, and water valves shall be adjusted and balanced to deliver within 10% of the specified quantities indicated on the Drawings. Where the equipment or systems depend upon controls for proper operation, functioning and performance, the Engineer may ask the Contractor that the later shall be

operated simultaneously with the equipment or system during tests.

If the air quantities cannot be delivered without exceeding the speed range of the sheaves or the available horsepower, the Engineer shall be notified before proceeding with the balancing of air distribution system.

Any addition/replacements required to meet the specified flow rates shall be the responsibility of the Contractor at his own cost.

The balancing and commissioning work will be done by a specialized firm/approved by the Engineer, having working experience of more than five (05) years along with working experience of at least five (05) projects of similar nature.

9-03.2 Commissioning

Upon completion of air and water balancing and when the whole or part of HVAC System is substantially complete and ready for operation as specified, the Contractor shall carry out Commissioning. Appropriate Seasons are not necessary and the purpose of the commissioning is to start-up the whole or part of HVAC System with manual and/or automatic controls and to put the whole or part of HVAC plant in operation to make it ready to provide cooling and/or heating.

The Commissioning shall be considered completed when complete HVAC plant put into operation and made ready to provide either cooling or heating as directed by the Engineer. The Engineer may direct the Contractor to commission part of central plant along with part of AHUs, FCUs and distribution network. This will be considered as partial commissioning.

9-04 PERFORMANCE TESTS

Each equipment of HVAC plant shall be tested for performance after successful completion of Commissioning of that equipment to determine the Specified and Guaranteed Data at Specified Operating Conditions as shown in Equipment Schedule and Specifications. These tests shall be carried out in appropriate seasons.

The test data shall not deviate by more than five percent (5%) from the guaranteed capacity data.

Should any part of the apparatus or system fail to meet the specification requirements, it shall be adjusted, repaired or replaced to the satisfaction of the Engineer by the Contractor at his own cost. The complete Performance Test shall than be repeated.

9-05 RELIABILITY TRIAL TEST

After completing the above Preliminary Tests, adjustments, Commissioning and Performance Tests, the Contractor shall carry out Reliability Trial Tests for the whole or part of system.

The trial tests, both for summer and winter, shall last for a period of 14 consecutive days during which time the whole or part of the system, as the case may be, shall operate continuously without major adjustment or repair to the satisfaction of the Engineer.

Should any part of the apparatus or system fail to operate continuously as specified, it shall be adjusted, repaired or replaced to the satisfaction of the Engineer and the Reliability Trial Tests shall be repeated for another 14 consecutive days for continuous operation without major adjustment or repair.

Reliability Trial Tests should be carried out during appropriate seasons in Defects Liability Period.

SECTION 10 - MEASUREMENTS AND PAYMENTS

10-01 GENERAL

Unless expressly excluded, the cost of all materials, equipment and works required by Special Provisions and Technical Provisions of Specifications, acceptably furnished, installed and tested as Specified, shall be considered to be included in the amounts tendered against the item listed in the Schedule of Prices.

10-02 SOP ITEM NO. 1 (a), 2 (a) 3 (a & b), 12 (a through h), 15 & 17

10-02.1 Measurement

Measurement will be made of each item and all associated accessories and work acceptably furnished, installed and tested as individual units.

10-02.2 Payment

Payment of these items will be made at the Contract Unit Rates for these items entered in Schedule of Prices.

10-03 SOP ITEM NO. 4 & 16

10-03.1 Measurement

No measurement will be made of the items mentioned above.

10-03.2 Payment

Payment will be made at a Contract Lump sum Price entered for the respective item in Schedule of Prices.

10-04 SOP ITEM NO. 5 & 9

10-04.1 Measurement

Measurement will be made for surface area of installed sheet metal ducting and plenums and grease exhaust duct for different gauges. No measurement will be made for wastage, bracing flanges, hangers and supports, fasteners, anchor bolts air-turning vanes, splitter dampers, and grease exhaust duct protection.

10-04.2 Payment

Payment will be made for the number of units measured as provided above at the Contract Unit Rates as entered in SOP.

10-05 SOP ITEM NO. 6 & 7

10-05.1 Measurement

Measurement will be made of the core area of the respective item acceptably furnished, installed and tested. No measurement will be made of accessories and attachments.

10-05.2 Payment

Payment will be made for the number of units measured as provided above at the Contract Unit Rates as entered in SOP.

10-06 SOP ITEM NO. 13 (a through c)

10-06.1 Measurement

Measurement will be made of the area of sheet metal to which the acoustic Liner or insulation is applied. No measurement will be made for accessories and adhesive.

10-06.2 Payment

Payment or deduction will be made for the number of units measured as above at the Contract Unit Rates entered in SOP.

10-07 SOP ITEM NO. 10 & 11

10-07.1 Measurement

Measurement will be made of the length of pipe at centre line of pipe, fittings and accessories, acceptably furnished, installed and tested. No measurement will be made for fittings, accessories, attachments, hangers, nuts and bolts.

10-07.2 Payment

Payment will be made for the number of units measured as provided above at the Contract Unit Rates as entered in SOP.

10-08 SOP ITEM NO. 13 (d & e)

10-08.1 Measurement

Measurement will be made of the length of piping at center line, to which the insulation is applied. No measurement will be made for accessories, adhesive, etc.

10-08.2 Payment

Payment will be made for the number of units measured as above at the Contract Unit Rates entered in SOP.

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EQUIPMENT SCHEDULE

FAISALABAD INSTITUTE OF CARDIOLOGY, FAISALABAD

CHILLERS-HEATERS

(JCI STANDARDS)

EQUIPMENT SCHEDULE
SHEET 1 OF 5

1	CODE	CH-1
2	TYPE	DUAL FUEL DIRECT FIRED DOUBLE EFFECT ABSORPTION CHILLER-HEATER
3	MAKE	SEE NOTE-3
4	MODEL	---
5	COP (MINIMUM) AT FULL LOAD	1.3
5	COUNTRY OF MANUFACTURE	SEE NOTE-3
6	COOLING CAPACITY, TR.(MINIMUM) AT SPECIFIED CONDITIONS,(SEE NOTE-1)	560
7	HEATING CAPACITY (MBH)	2688
8	POWER CONSUMPTION	---
9	CHILLED WATER SYSTEM	
	a) WATER FLOW RATE (USGPM)	1344
	b) MAX. PD, IN EVAP. FT. WG	25
	c) EWT, deg F	54
	d) LWT, deg F	44
10	HOT WATER SYSTEM	
	a) WATER FLOW RATE (USGPM)	538
	b) MAX. PD, IN EVAP. FT. WG	25
	c) EWT, deg F	--
	d) LWT, deg F	140
11	CONDENSER WATER	
	a) WATER FLOW RATE (USGPM)	2464
	b) MAX. PD, FT. WG	25
	c) EWT, deg F	90
	d) LWT, deg F	100
12	POWER SUPPLY	
13	EQUIPMENT POWER RATING	400V/3PH/50HZ
14	FOULING FACTOR (Sq.FT deg F/BTU/HR)	
	a) EVAPORATOR	0.0005
	b) CONDENSER	0.00025
15	TYPE OF CONTROLS	MICROPROCESSOR, OPEN PROTOCOL
16	STARTER TYPE	MICROPROCESSOR
17	BURNER TYPE	
18	TYPE OF FUEL	DUAL: GAS, DIESEL OIL
19	GAS CALORIFIC VALUE (BTU/LB.CFT.F)	970
20	MATERIAL	
	a) HEATING ELEMENT	--
	b) VESSEL	--
21	WORKING PRESSURE (PSI) (WATER SIDE)	125
22	INSULATION MATERIAL AND TYPE	AS PER MANUFACTURER RECOMMENDATION
23	OPERATING WEIGHT, LBS	--
24	ACCESSORIES	MANUAL PURGING PUMP WITH AUTOMATIC PURGING
25	REMARKS	--

NOTE:

1. WHEN CHILLERS HAVING CATELOGUED STANDARD COMPONENTS WITH SPECIFIED EXACT CAPACITY IS NOT AVAILABLE, NEXT LARGER UNIT HAVING CATELOGUED STANDARD COMPONENTS SHALL BE PROVIDED
2. SHIPMENT DOCUMENT SHOULD MENTION THAT THE CHILLER ARE FOR INSTALLATION AT THIS SITE.
3. FOR "MAKE" AND "COUNTRY" OF MANUFACTURE SEE SCHEDULE H TO BID OF VOLUME-I "LIST OF APPROVED MANUFACTURERS FOR ITEMS/MATERIALS/EQUIPMENT OF HVAC WORKS".
4. ALL CHILLERS HAVE PRE-SHIPMENT PERFORMANCE TESTING ON FULL & PART LOAD WITNESS BY CONSULTANT AND CLIENT FOR ABSORPTION WATER CHILLING AND WATER HEATING PACKAGE" AS PER CLAUSE 51.5 OF PARTICULAR CONDITIONS OF CONTRACT OF VOLUME-I
5. CONTRACTOR MUST CHECK AVAILABLE GAS PRESSURE AND RESOPONSIBLE FOR MEETING ALL REQUIREMENTS RELATED TO PRESSURE REGULATION FOR CHILLERS. REFERENCE: ASHRAE STANDARD 90.1-2016

FAISALABAD INSTITUTE OF CARDIOLOGY, FAISALABAD

COOLING TOWER
(CTI/JCI CERTIFIED)

EQUIPMENT SCHEDULE
SHEET 2 OF 5

1	CODE	CT-1
2	TYPE	PACKAGED TYPE 'CROSS FLOW INDUCED DRAFT TOP AIR DISCHARGE
3	MAKE (FOR REF. ONLY)	SEE NOTE-1
4	MODEL	--
5	COUNTRY OF MANUFACTURE	SEE NOTE-1
6	WATER FLOW RATE (USGPM)	2464
7	EWT, deg F	100
8	LWT, deg F	90
9	AIR EWB deg F	82
10	NO. OF CELLS (MINIMUM)	2
11	MOTOR	
	a) HP	---
	b) POWER SUPPLY SYSTEM	415 V/3-PH/50 HZ
	c) EQUIPMENT VOLTAGE RATING	400 V
	d) RPM	---
12	OPERATING WEIGHT,LBS (MAX)	---
13	ACCESSORIES	AS SPECIFIED
14	REMARKS	

NOTE:
1. VIBRATION ISOLATORS SHALL BE PROVIDED FROM MANUFACTURER.
2. ACCESSORIES/ OPTIONAL ITEM AS PER CLAUSE 2-08 OF TECHNICAL PROVISION.
3. FOR "MAKE" AND "COUNTRY" OF MANUFACTURE SCHEDULE H TO BID OF VOLUME-I"LIST OF APPROVED MANUFACTURERS FOR ITEMS/MATERIALS/EQUIPMENT OF HVAC WORKS".
4. MOTOR MAKE/ MODEL SHALL BE PROVIDED AT TIME OF SUBMITTAL FOR APPROVAL.
5. ALL MOTORS SHALL BE DESIGNED FOR CONTINUOUS OPERATION IN THE AMBIENT TEMPERATURE OF 115 ºF (46 ºC).

FAISALABAD INSTITUTE OF CARDIOLOGY, FAISALABAD

AIR HANDLING UNITS (GENERAL)
(EUROVENT CERTIFIED-MATERIAL AND PERFORMANCE)

EQUIPMENT SCHEDULE

CODE	TYPE	SECTION CONFIGURATION	SUPPLY FAN			OUTDOOR AIR (OA)	RETURN AIR (RA)	DISCH ARR.	REFER TO SCHEDULE OF CCHC.	REF TO SCH.OF MXB	HUMIDIFIER			AREA SERVED
			CFM	EXT SP (IN)	MAX OV (FPM)	(CFM)	(CFM)		CCHC NO.	MXB NO.	CODE	TYPE	EVAP. RATE (LBS/HR)	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
AHU-F5	DOUBLE SKIN SINGLE ZONE, HDT, FLOOR MOUNTED	MXB-FF-BF-HUM-CCHC-FAN	21450	2	2000	4349	17101	UB	14	14	HUM-1	S	101.4	ICU/IICU

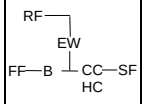
LEGEND:

CFM = CUBIC FEET/MINUTE
HDT = HORIZANTOL DRAW THRU
TH = TOP HORIZANTOL
UB = UP BLAST
VDT = VERTICAL DRAW THRU
CCHC = COMBINATION COOLING-HEATING COIL
HUM = HUMIDIFIER
MXB = MIXING BOX
F.F = FLAT FILTER BOX WITH HIGH VELOCITY FILTER
B.F = BAG FILTER BOX WITH HIGH VELOCITY FILTER
FPM = FEET PER MINUTE
S= STEAM HUMIDIFIER
SAF = SUPPLY AIR FAN
RAF = RETURN AIR FAN

NOTES:

1. FAN SHOULD BE SELECTED FOR TOTAL SP= ESP+AHU SP + FILTER PRESSURE LOSS (AVG. OF MFR RECOMMENDED DIRTY & CLEAN FILTER)
2. MOTOR HP SHALL BE ATLEAST 120 % OF REQUIRED BHP.
3. 'FOR "MAKE" AND "COUNTRY" OF MANUFACTURE SEE SCHEDULE H TO BID OF VOLUME-I "LIST OF APPRO\ 'MANUFACTURERS FOR ITEMS/MATERIALS/EQUIPMENT OF HVAC WORKS".
4. AHUs INSTALLED OUTSIDE SHALL BE WEATHER PROOF TYPE WITH WEATHER RESISITANT CANOPY SUITABLE FOR EXPOSED TO VISION INSTALLATION.
5. ALL MOTORS SHALL BE DESIGNED FOR CONTINUOUS OPERATION IN THE TEMPERATURE OF 104 ºF (40 ºC).

FAISALABAD INSTITUTE OF CARDIOLOGY, FAISALABAD
AIR HANDLING UNITS (HEAT RECOVERY TYPE)
(EUROVENT CERTIFIED-MATERIAL AND PERFORMANCE)

CODE	TYPE	QTY.	SECTIONAL CONFIGURATION	SUPPLY AIR FAN DATA				EXHAUST AIR FAN DATA			HEAT RECOVERY WHEEL DATA						DISCH ARR.	REFER TO SCHEDULE OF CCHC	REFER TO SCHEDULE OF MXB	HUMIDIFIER			AREA SERVED
				SUPPLY AIR (CFM)	EXT SP (IN)	MAX OV (FPM)	FRESH AIR (CFM)	CFM	EXT SP (IN)	MAX OV (FPM)	TYPE	MINIMUM EFFECIENCY	AIR TEMPERATURE										
												(%)	EDB (ºF)	EWB (ºF)	LDB (ºF)	LWB (ºF)		CCHC NO.	MXB NO.	CODE	TYPE	EVAP. RATE (LBS/HR	
1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
AHU-F4	HORIZONTAL DRAW THRU DOUBLE SKIN 100% FRESH AIR HEAT RECOVERY TYPE AIR HANDLER	1		10,884	5	2000		6,722	5	2000	ENTHALPY WHEEL	75	115.00	85.64	84.02	74.30	UB	13	-	-	-	-	'OT 3, 4 & 5

LEGEND:

CFM = CUBIC FEET/MINUTE
HDT = HORIZANTOL DRAW THRU
TH = TOP HORIZANTOL
UB = UP BLAST
VDT = VERTICAL DRAW THRU
EDB = ENTERING DRY BULB TEMPERATURE
EWB=ENTERING WET BULB TEMPERATURE
LDB=LEAVING DRY BULB TEMPERATURE
LWB=LEAVING WET BULB TEMPERATURE

CCHC = COMBINATION COOLING-HEATING COIL
HUM = HUMIDIFIER
MXB = MIXING BOX
F.F = FLAT FILTER BOX WITH HIGH VELOCITY FILTER
B.F = BAG FILTER BOX WITH HIGH VELOCITY FILTER
FPM = FEET PER MINUTE
S= STEAM HUMIDIFIER
SF = SUPPLY AIR FAN
RF = RETURN AIR FAN
EW=ENTHALPY WHEEL

NOTES:

1. FAN SHOULD BE SELECTED FOR TOTAL SP= ESP+AHU SP + FILTER PRESSURE LOSS (AVG. OF MFR RECOMMENDED DIRTY & CLEAN FILTER)
2. MOTOR HP SHALL BE ATLEAST 120 % OF REQUIRED BHP.
3. 'FOR "MAKE" AND "COUNTRY" OF MANUFACTURE SEE SCHEDULE H TO BID OF VOLUME-I "LIST OF APPROVED 'MANUFACTURERS FOR ITEMS/MATERIALS/EQUIPMENT OF HVAC WORKS".
4. AHUs INSTALLED OUTSIDE SHALL BE WEATHER PROOF TYPE WITH WEATHER RESISITANT CANOPY SUITABLE FOR EXPOSED TO VISION INSTALLATION.
5. ALL MOTORS SHALL BE DESIGNED FOR CONTINUOUS OPERATION IN THE TEMPERATURE OF 104 ºF (40 ºC).

FAISALABAD INSTITUTE OF CARDIOLOGY, FAISALABAD

AIR HANDLING UNITS (COIL)
(EUROVENT CERTIFIED-MATERIAL AND PERFORMANCE)

EQUIPMENT SCHEDULE

CODE	INSTALLED IN	AIR THRU COIL (CFM)	MAX. COIL FV	COOLING (AIR SIDE)				COOLING (WATER SIDE)				HEATING (AIR SIDE	HEATING (WATER SIDE)			
				TH (MBH)	EDB deg F	EWB deg F	SH (MBH)	EWT deg F	LWT deg F	MAX.FLOW RATE USGPM	MAX. PD FT.WG	TH (MBH)	EWT deg F	LWT deg F	MAX.FLOW RATE USGPM	MAX. PD FT.WG
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CCHC-F4	AHU-F4	10884	500	834.0	103.40	81.00	416.505	44.00	-	167	20	245.776	140	-	49	20
CCHC-F5	AHU-F5	21450	500	869.0	79.40	64.60	164.800	44.00	-	174	20	319.627	140	-	64	20

LEGEND:

CCHC	COMBINATION COOLING-HEATING COIL	EAT	ENTERING AIR TEMPERATURE	TH	COIL TOTAL HEAT
CFM	CUBIC FEET PER MINUTE	EDB	ENTERING DRY BULB TEMPERATURE	USGPM	UNITED STATES GALLON PER MINUTE
FPM	FEET PER MINUTE	EWB	ENTERING WET BULB TEMPERATURE	LAT	LEAVING AIR TEMPERATURE
SH	COIL SENSIBLE HEAT	EWT	ENTERING WATER TEMPERATURE	LWT	LEAVING WATER TEMPERATURE

FAISALABAD INSTITUTE OF CARDIOLOGY, FAISALABAD

AIR HANDLING UNITS (MIXING BOX)
(EUROVENT CERTIFIED-MATERIAL AND PERFORMANCE)

EQUIPMENT SCHEDULE
SHEET 5 OF 5

CODE	INSTALLED WITH	AIR ENTERS FROM			RETURN AIR (RA) (CFM)	FRESH AIR (OA) (CFM)	BY PASS AIR (CFM)	ACCESSORIES	REMARKS
		RA	OA	BY PASS AIR					
1	2	3	4	5	6	7	8	9	10
14	AHU-F5	TOP	REAR		17101	4349		AS SPECIFIED	

NOTE: RATINGS ARE FOR SELECTION PURPOSE ONLY. SCHEDULE WILL BE UPDATED FOR OPERATINGVALUES AT INSTALLATION STAGE

SCHEDULE OF PRICES

FAISALABAD INSTITUTE OF CARDIOLOGY, FAISALABAD

SCHEDULE OF PRICES FOR

SUPPLY, INSTALLATION, TESTING, AND COMMISSIONING OF ONE (01) CHILLER, ONE (01) COOLING TOWER, AND TWO (02) AIR HANDLING UNITS (AHUs) AND ACCESSORIES WITH ASSOCIATED HVAC WORKS

ITEM NO.	DESCRIPTION OR CODE		UNIT	QTY	UNIT RATES (PKR)	TOTAL AMOUNT (PKR) COL 4 x COL 5
1	2		3	4	5	6
1		**SUPPLY AND INSTALLATION OF DUAL FUEL DIRECT FIRED HIGH EFFICIENCY TYPE DOUBLE EFFECT ABSORPTION CHILLER-HEATER SPECIFIED CONDITIONS AS SCHEDULED INCLUDING SPARE PARTS, TRANSPORTATION, INSURANCE, UNLOADING, STORAGE, LIFTING, PLACING, FIXING AT FOUNDATIONS, INSULATION INCLUDING ALL TAXES AND DUTIES AND OPERATION & MAINTENANCE DURING ONE (01) YEAR DEFECT LIABILITY PERIOD.**				
	a)	CH-1	EACH	1		
2		**SUPPLY, ASSEMBLING AND INSTALLATION OF PACKAGED TYPE CROSS FLOW INDUCED DRAFT TOP AIR DISCHARGE COOLING TOWER (CTI/JCI CERTIFIED) HAVING TWO CELL AS SCHEDULED COMPLETE WITH SPARE PARTS, TRANSPORTATION, INSURANCE, UNLOADING, STORAGE, LIFTING, PLACING AT FOUNDATION INCLUDING ALL TAXES AND DUTIES AND OPERATION & MAINTENANCE DURING ONE (01) YEAR DEFECT LIABILITY PERIOD.**				
	a)	CT-1	EACH	1		
3		**SUPPLY AND INSTALLATION OF AIR HANDLING UNITS (EUROVENT CERTIFIED) MEDICAL GRADE INCULDING ALL SECTIONS AND COMPONENTS AS SPECIFIED & SCHEDULED COMPLETE WITH SPARE PARTS, TRANSPORTATION, INSURANCE, UN-LOADING, STORAGE, LIFTING, PLACING AT FOUNDATIONS AT LOCATIONS INCLUDING ALL TAXES AND DUTIES AND OPERATION & MAINTENANCE DURING ONE (01) YEAR DEFECT LIABILITY PERIOD.**				
	a)	AHU-F4 WITH HEAT RECOVERY SECTION	EACH	1		
	b)	AHU-F5	EACH	1		

FAISALABAD INSTITUTE OF CARDIOLOGY, FAISALABAD

SCHEDULE OF PRICES FOR

SUPPLY, INSTALLATION, TESTING, AND COMMISSIONING OF ONE (01) CHILLER, ONE (01) COOLING TOWER, AND TWO (02) AIR HANDLING UNITS (AHUs) AND ACCESSORIES WITH ASSOCIATED HVAC WORKS

ITEM NO.		DESCRIPTION OR CODE	UNIT	QTY	UNIT RATES (PKR)	TOTAL AMOUNT (PKR) COL 4 x COL 5
1		2	3	4	5	6
4		**SUPPLY, INSTALLATION AND TESTING & COMMISSIONING OF CHEMICAL FEEDERS AND CHEMICALS AS SPECIFIED**				
	a)	CHEMICALS FOR CONDENSER WATER SYSTEM TO BE USED DURING TESTING & COMMISSIONING AND DEFECTS LIABILITY PERIOD	LOT	1		
	b)	CHEMICALS FOR CHILLED/HOT WATER SYSTEM TO BE USED DURING TESTING & COMMISSIONING AND DEFECTS LIABILITY PERIOD	LOT	1		
5		**SUPPLY, FABRICATION AND INSTALLATION OF G.I. SHEET METAL DUCTWORK COMPLETE WITH HANGERS, SPLITTER DAMPERS, BRACINGS ETC.**				
		AS SPECIFIED EXCEPT BOQ ITEM NO.				
	a)	U.S GAUGE 22	SFT	330		
	b)	U.S GAUGE 20	SFT	495		
6		**SUPPLY & INSTALLATION OF 16 GAUGE G.I. SHEET VOLUME DAMPERS**	SFT	40		
7		**SUPPLY & INSTALLATION OF 16 GAUGE G.I. SHEET FIRE DAMPERS**	SFT	40		
8		**SUPPLY & INSTALLATION OF PRE-ASSEMBLED FLEXIBLE DUCT CONNECTORS FACTORY FABRICATED WITH COATED WOVEN FABRIC AND G.I. COLLARS BOTH BY MEANS OF DOUBLE LOCK SEAM ON EACH SIDE AS SPECIFIED.**				
	a)	FLEXIBLE CONNECTION (RECTANGULAR)	SFT	30		
9		**BREACHING / FLUE STACK**	SFT	16		
10		**SUPPLY, FABRICATION AND INSTALLATION OF SEAMLESS M.S. SCHEDULE 40 PIPING & FITTINGS EXCLUDING VALVES AND STRAINERS AND INCLUDING HANGERS, ANCHOR BOLTS, RUBBER VIBRATION MOUNTS ETC INCLUDING ALL TAXES AND DUTIES ALONG WITH OPERATION & MAINTENANCE DURING ONE (01) YEAR DEFECT LIABILITY PERIOD.**				
	a-1)	DIA 3"	RFT	30		
	a-2)	DIA 8"	RFT	30		
	a-3)	DIA 10"	RFT	30		

FAISALABAD INSTITUTE OF CARDIOLOGY, FAISALABAD

SCHEDULE OF PRICES FOR

SUPPLY, INSTALLATION, TESTING, AND COMMISSIONING OF ONE (01) CHILLER, ONE (01) COOLING TOWER, AND TWO (02) AIR HANDLING UNITS (AHUs) AND ACCESSORIES WITH ASSOCIATED HVAC WORKS

ITEM NO.	DESCRIPTION OR CODE		UNIT	QTY	UNIT RATES (PKR)	TOTAL AMOUNT (PKR) COL 4 x COL 5
1	2		3	4	5	6
11		**SUPPLY, FABRICATION AND INSTALLATION OF CONDENSATE DRAIN PIPING & FITTINGS EXCLUDING VALVES AND STRAINERS AND INCLUDING HANGERS, ANCHOR BOLTS, RUBBER VIBRATION MOUNTS ETC INCLUDING ALL TAXES AND DUTIES ALONG WITH OPERATION & MAINTENANCE DURING ONE (01) YEAR DEFECT LIABILITY PERIOD.**				
	b-1)	DIA 1-1/2"	RFT	15		
	b-2)	DIA 1"	RFT	15		
12		**SUPPLY AND INSTALLATION OF VALVES AND SPECIALTIES INCLUDING ALL ACCESSORIES**				
		GATE VALVES				
	a-1)	DIA 3"	EACH	10		
	a-2)	DIA 8"	EACH	2		
	a-3)	DIA 10"	EACH	2		
		GLOBE VALVES				
	b-1)	DIA 3"	EACH	2		
	b-2)	DIA 8"	EACH	3		
	b-3)	DIA 10"	EACH	1		
		CHECK VALVE				
	c-1)	DIA 8"	EACH	1		
	c-2)	DIA 10"	EACH	1		
		BALANCING VALVE				
	d-1)	DIA 3"	EACH	2		
	d-2)	DIA 8"	EACH	1		
	d-3)	DIA 10"	EACH	1		
		DRAIN COCKS				
	g-1)	DIA 1"	EACH	4		

FAISALABAD INSTITUTE OF CARDIOLOGY, FAISALABAD

SCHEDULE OF PRICES FOR

SUPPLY, INSTALLATION, TESTING, AND COMMISSIONING OF ONE (01) CHILLER, ONE (01) COOLING TOWER, AND TWO (02) AIR HANDLING UNITS (AHUs) AND ACCESSORIES WITH ASSOCIATED HVAC WORKS

ITEM NO.	DESCRIPTION OR CODE		UNIT	QTY	UNIT RATES (PKR)	TOTAL AMOUNT (PKR) COL 4 x COL 5
1	2		3	4	5	6
		STRAINERS				
	h-1)	DIA 3"	EACH	2		
13		**INSULATION**				
	a)	INDOOR SUPPLY/RETURN AIR DUCT EXPOSED TO VISION	SFT	850		
		IN AHU ROOMS				
	b)	ACOUSTIC LINER ON SUPPLY AIR DUCTS AND SHEET	SFT	250		
		METAL AIR PLENUMS				
	c)	INSULATION FOR FLUE STACK	SFT	10		
	d-1)	INSULATION FOR AHU ROOM CHILLED/HOT WATER				
		PIPING, FITTINGS, ACCESSORIES AND VALVES				
		iv) DIA 3"	RFT	10		
	d-2)	INSULATION FOR CPR & OUTDOOR CHILLED/ HOT WATER				
		PIPING, FITTINGS ACCESSORIES AND VALVES				
		iv) DIA 8"	RFT	10		
		v) DIA 10"	RFT	10		
	e)	INSULATION FOR COOLING COIL CONDENSATE DRAIN PIPING INCLUDING FITTING & ACCESSORIES	RFT	50		
14		**PAINTING AND EQUIPMENT IDENTIFICATION**	JOB	1		
15		**SUPPLY AND INSTALLATION OF INSTRUMENTS AND GAUGES INCLUDING SPARES**				
	a)	PRESSURE GAUGES, INCLUDING STOP COCK & SIPHON	EACH	8		
	b)	PIPELINE THERMOMETERS, INCLUDING WELLS	EACH	8		
16		**INSPECTION AT SITE, TESTING AND COMMISSIONING**	JOB	1		
		OF OVERALL SYSTEM				
17		**OPERATION AND MAINTENANCE DURING DEFECTS LIABILITY PERIOD**	MONTHS	12		

TOTAL (SUM OF COL-6)

IN WORDS : RUPEES _____

IINITIALS OF SIGNATORY TO BID .....