SINDH INSTITUTE OF ANIMAL HEALTH
LIVESTOCK & FISHERIES DEPARTMENT, GOVT. OF SINDH
Animal Science Complex, Korangi Industrial Area near Singer Chowrangi,
Korangi, Karachi-74900 Tel: 021-35123347 Email: siah.care@gmail.com

Bidding Documents

for National Competitive Bidding

under ADP scheme No 1509
"Gap Analysis and Compliance of DRAP at Sindh Institute of Animal Health Karachi"

(Single Stage Two Envelope Procedure)

Procurement of Goods
PLANT & MACHINERY

PART ONE (FIXED)

- Instructions to Bidders (ITB)
- General Conditions of Contract (GCC)

Tender Ref No. SIAH/ADP1509/Mach/25-26 Due on dated: 03.02.2026

Issued to: _____ P. O. No.: _____

Issue Date: _____ Signature: _____

SINDH INSTITUTE OF ANIMAL HEALTH

LIVESTOCK & FISHERIES DEPARTMENT, GOVT. OF SINDH
Animal Science Complex, Near Singer Chowrangi, Korangi, Karachi-74900
Tel: 021-35123347 Fax: 021-35123340 Email: siah.care@gmail.com

TENDER NOTICE

Sealed tenders are invited for supply of the following items to Sindh Institute of Animal Health, Karachi under **ADP scheme No. 1509 "Gap Analysis and Compliance of DRAP at Sindh Institute of Animal Health Karachi"** for the year 2025-26 from the manufacturers, importers, sole agents and general suppliers under SPPRA Rules 2010 and amendment made therein.

S. #	Description	Tender No.	Bid Security Amount	Tender document fee non-refundable
01.	Plant & Machinery	SIAH/ASC/ADP1509/Plant/25-26	6,100,000	Rs. 1,000
02.	Furniture & Fixture	SIAH/ASC/ ADP1509/Furniture/25-26	5,000,000	Rs. 1,000

The tender documents containing detailed specifications, terms and conditions can be obtained from EPADS portal https://sindh.eprocure.gov.pk upon payment of tender cost (non-refundable) through Pay order issued in favor of Sindh Institute of Animal Health, Karachi as per follows:

Date of issue	Date of receiving and opening
Tenders shall be issued from **19-01-2026 to 02-02-2026**	Sealed envelop of tenders shall be received on **03-02-2026 up to 02:00 PM** and technical bid opened on same day at **02:30 PM** before the representative of bidders at Committee Room of SIAH, Karachi.

TERMS AND CONDITIONS

01. Single Stage-Two Envelopes Procedure will be adopted.
02. The bidders are required to attached bid security in shape of payorder / demand draft issued by scheduled bank in Pakistan in favor of Sindh Institute of Animal Health Karachi and submit in E-proposal and original (hard copy) with the bid on address mentioned below on or before 03.02.2026 upto 02:00 pm.
03. Partial and incomplete bids will not be considered. If the bidder failed to submit the bid on online EPADS Portal and bids received after prescribed date and time will be rejected. If the opening date is declared as holiday then the tender will be opened on next working day at same time.
04. The **"Financial Bid"** of only **"Technical Qualified Firms"** will be opened in presence of their respective representatives at the date and time to be determined and communicated later.
05. The Procuring agency shall announce the results of bid evaluation in the form of a report giving reasons for acceptance or rejection of bids, as per SPPRA Rules 2010 (and amendments made therein).

Director General,
Sindh Institute of Animal Health,
Animal Science Complex, Korangi, Karachi

Preface

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

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

This is Part one which is fixed and contains provisions which are to be used unchanged. Each section is prepared with notes intended only as information for the Procuring agency or the person drafting the bidding documents. They shall not be included in the final documents.

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Part One - Section I.

Instructions to Bidders

Table of Clauses

Instructions to Bidders

A. Introduction

1. Source of Funds

1.1 The Procuring agency has received /applied for loan/grant/federal/provincial/local government funds from the source(s) indicated in the bidding data in various currencies towards the cost of the project /schemes specified in the bidding data and it is intended that part of the proceeds of this loan/grant/funds/ will be applied to eligible payments under the contract for which these bidding documents are issued.

1.2 Payment by the Fund will be made only at the request of the Procuring agency and upon approval by the Government of Sindh., and in case of a project will be subject in all respect to the terms and conditions of the agreement. The Project Agreement prohibits a withdrawal from the allocated fund account for the purpose of any payment to persons or entities, or for any import of goods, if such payment or import, to the knowledge of the Federal Government/ Sindh Government, is prohibited by a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations. No party other than the Procuring agency shall derive any rights from the Project Agreement or have any claim to the allocated fund proceeds.

2. Eligible Bidders

2.1 This Invitation for Bids is open to all suppliers from eligible source as defined in the SPP Rules, 2009 and its Bidding Documents except as provided hereinafter.

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

2.3 Government-owned enterprises in the Province of Sindh may participate only if they are legally and financially autonomous, if they operate under commercial law, and if they are not a dependent agency of the Government of Sindh.

2.4 Bidders shall not be eligible to bid if they are under a declaration of ineligibility for corrupt and fraudulent practices issued by the

any government organization in accordance with sub clause 34.1

3. Eligible Goods and Services

3.1 All goods and related services to be supplied under the contract shall have their origin in eligible source countries, defined in the SPP Rules, 2009 and its Bidding Documents ,and all expenditures made under the contract will be limited to such goods and services.

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

3.3 The origin of goods and services is distinct from the nationality of the Bidder.

4. Cost of Bidding

4.1 The Bidder shall bear all costs associated with the preparation and submission of its bid, and the Procuring agency named in the Bid Data Sheet, hereinafter referred to as "the Procuring agency," will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

B. The Bidding Documents

5. Content of Bidding Documents

5.1 the bidding documents include:

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

5.2 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 will be at the Bidder's risk and may result in the

rejection of its bid.

6. Clarification of Bidding Documents

6.1 A interested Bidder requiring any clarification of the bidding documents may notify the Procuring agency in writing. The Procuring agency will respond in writing to any request for clarification of the bidding documents which it receives no later than three working days prior to the deadline for the submission of bids prescribed in the Bid Data Sheet. Written copies of the Procuring agency's response (including an explanation of the query but without identifying the source of inquiry) will be sent to all interested 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 interested Bidder, may modify the bidding documents by amendment.

7.2 All interested bidders that have received the bidding documents will be notified of the amendment in writing, and will be binding on them.

7.3 In order to allow interested 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.

C. Preparation of Bids

8. Language of Bid

8.1 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 the language specified in the Bid Data Sheet. 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 the language specified in the Bid Data Sheet, in which case, for purposes of interpretation of the Bid, the translation shall govern.

9. Documents Comprising the Bid

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

(a) a Bid Form and a Price Schedule completed in accordance with ITB Clauses 10, 11, and 12;

(b) documentary evidence established in accordance with ITB

Clause 13 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 14 that the goods and ancillary services to be supplied by the Bidder are eligible goods and services and conform to the bidding documents; and

(d) bid security furnished in accordance with ITB Clause 15.

10. Bid Form

10.1 The Bidder shall complete the Bid Form and the appropriate Price Schedule furnished in the bidding documents, indicating the goods to be supplied, a brief description of the goods, their country of origin, quantity, and prices.

11. Bid Prices

11.1 The Bidder shall indicate on the appropriate Price Schedule the unit prices (where applicable) and total bid price of the goods it proposes to supply under the contract.

11.2 Prices indicated on the Price Schedule shall be delivered duty paid (DDP) prices. The price of other (incidental) services, if any, listed in the Bid Data Sheet will be entered separately.

11.3 The Bidder's separation of price components in accordance with ITB Clause 11.2 above will be solely for the purpose of facilitating the comparison of bids by the Procuring agency and will not in any way limit the Procuring agency's right to contract on any of the terms offered.

11.5 Prices quoted by the Bidder shall be fixed during the Bidder's performance of the contract and not subject to variation on any account, unless otherwise specified in the Bid Data Sheet. A bid submitted with an adjustable price quotation will be treated as nonresponsive and will be rejected, pursuant to ITB Clause 24. If, however, in accordance with the Bid Data Sheet, prices quoted by the Bidder shall be subject to adjustment during the performance of the contract, a bid submitted with a fixed price quotation will not be rejected, but the price adjustment would be treated as zero.

12. Bid Currencies

12.1 Prices shall be quoted in Pak Rupees unless otherwise specified in the Bid Data Sheet.

13. Documents Establishing Bidder's

13.1 Pursuant to ITB Clause 9, the Bidder shall furnish, as part of its bid, documents establishing the Bidder's eligibility to bid and its qualifications to perform the contract if its bid is accepted.

Eligibility and Qualification

13.2 The documentary evidence of the Bidder's eligibility to bid shall establish to the Procuring agency's satisfaction that the Bidder, at the time of submission of its bid, is from an eligible country as defined under ITB Clause 2.

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

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

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

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

(d) that the Bidder meets the qualification criteria listed in the Bid Data Sheet.

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

14.1 Pursuant to ITB Clause 9, the Bidder shall furnish, as part of its bid, documents establishing the eligibility and conformity to the bidding documents of all goods and services which the Bidder proposes to supply under the contract.

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

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

(a) a detailed description of the essential technical and

performance characteristics of the goods;

(b) a list giving full particulars, including available sources and current prices of spare parts, special tools, etc., necessary for the proper and continuing functioning of the goods for a period to be specified in the Bid Data Sheet, following commencement of the use of the goods by the Procuring agency; and

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

14.4 For purposes of the commentary to be furnished pursuant to ITB Clause 14.3(c) above, the Bidder shall note that standards for workmanship, material, and equipment, as well as references to brand names or catalogue numbers designated by the Procuring agency in its Technical Specifications, are intended to be descriptive only and not restrictive. The Bidder may substitute alternative standards, brand names, and/or catalogue numbers in its bid, provided that it demonstrates to the Procuring agency's satisfaction that the substitutions ensure substantial equivalence to those designated in the Technical Specifications.

15. Bid Security

15.1 Pursuant to ITB Clause 9, the Bidder shall furnish, as part of its bid, a bid security in the amount specified in the Bid Data Sheet.

15.2 The bid security is required to protect the Procuring agency against the risk of Bidder's conduct which would warrant the security's forfeiture, pursuant to ITB Clause 15.7.

15.3 The bid security shall be in Pak. Rupees and shall be in one of the following forms:

(a) a bank guarantee or an irrevocable letter of credit issued by a reputable bank located in the Procuring agency's country, in the form provided in the bidding documents or another form acceptable to the Procuring agency and valid for thirty (30) days beyond the validity of the bid; or

15.4 Any bid not secured in accordance with ITB Clauses 15.1 and 15.3 will be rejected by the Procuring agency as nonresponsive, pursuant to ITB Clause 24.

15.5 Unsuccessful bidders' bid security will be discharged or returned as promptly as possible but not later than thirty (30) days after the expiration of the period of bid validity prescribed by the Procuring agency pursuant to ITB Clause 16.

15.6 The successful Bidder's bid security will be discharged upon the Bidder signing the contract, pursuant to ITB Clause 32, and furnishing the performance security, pursuant to ITB Clause 33.

15.7 The bid security may be forfeited:

(a) if a Bidder withdraws its bid during the period of bid validity specified by the Bidder on the Bid Form; or

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

(i) to sign the contract in accordance with ITB Clause 32;

or

(ii) to furnish performance security in accordance with ITB Clause 33.

16. Period of Validity of Bids

16.1 Bids shall remain valid for the period specified in the Bid Data Sheet after the date of bid opening prescribed by the Procuring agency, pursuant to ITB Clause 19. A bid valid for a shorter period shall be rejected by the Procuring agency as nonresponsive.

16.2 In exceptional circumstances, the Procuring agency may solicit the Bidder's consent to an extension of the period of validity. The request and the responses thereto shall be made in writing . The bid security provided under ITB Clause 15 shall also be suitably extended. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request will not be required nor permitted to modify its bid, except as provided in the bidding document.

17. Format and Signing of Bid

17.1 The Bidder shall prepare an original and the number of copies of the bid indicated in the Bid Data Sheet, clearly marking each "ORIGINAL BID" and "COPY OF BID," as appropriate. In the event of any discrepancy between them, the original shall govern.

17.2 The original and the copy or copies of the bid shall be typed or written in indelible ink and shall be signed by the Bidder or a

person or persons duly authorized to bind the Bidder to the contract. All pages of the bid, except for un-amended printed literature, shall be initialed by the person or persons signing the bid.

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

17.4 The Bidder shall furnish information as described in the Form of Bid on commissions or gratuities, if any, paid or to be paid to agents relating to this Bid, and to contract execution if the Bidder is awarded the contract.

D. Submission of Bids

18. Sealing and Marking of Bids

18.1 The Bidder shall seal the original and each copy of the bid in separate envelopes, duly marking the envelopes as "ORIGINAL" and "COPY." The envelopes shall then be sealed in an outer envelope.

18.2 The inner and outer envelopes shall:

(a) be addressed to the Procuring agency at the address given in the Bid Data Sheet; and

(b) bear the Project name indicated in the Bid Data Sheet, the Invitation for Bids (IFB) title and number indicated in the Bid Data Sheet, and a statement: "DO NOT OPEN BEFORE," to be completed with the time and the date specified in the Bid Data Sheet, pursuant to ITB Clause 2.2.

18.3 The inner envelopes shall also indicate the name and address of the Bidder to enable the bid to be returned unopened in case it is declared "late".

18.4 If the outer envelope is not sealed and marked as required by ITB Clause 18.2, the Procuring agency will assume no responsibility for the bid's misplacement or premature opening.

19. Deadline for Submission of Bids

19.1 Bids must be received by the Procuring agency at the address specified under ITB Clause 18.2 no later than the time and date specified in the Bid Data Sheet.

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 will thereafter be subject to the deadline as extended.

20. Late Bids

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 19 will be rejected and returned unopened to the Bidder.

21. Modification and Withdrawal of Bids

21.1 The Bidder may modify or withdraw its bid after the bid's submission, provided that written notice of the modification, including substitution or withdrawal of the bids, is received by the Procuring agency prior to the deadline prescribed for submission of bids.

21.2 The Bidder's modification or withdrawal notice shall be prepared, sealed, marked, and dispatched in accordance with the provisions of ITB Clause 18. by a signed confirmation copy, postmarked not later than the deadline for submission of bids.

21.3 No bid may be modified after the deadline for submission of bids.

21.4 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 by the Bidder on the Bid Form. Withdrawal of a bid during this interval may result in the Bidder's forfeiture of its bid security, pursuant to the ITB Clause 15.7.

E. Opening and Evaluation of Bids

22. Opening of Bids by the Procuring agency

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

22.2 The bidders' names, bid modifications or withdrawals, bid prices, discounts, and the presence or absence of requisite bid security and such other details as the Procuring agency, at its discretion, may consider appropriate, will be announced at the opening. No bid shall be rejected at bid opening, except for late bids, which shall be returned unopened to the Bidder pursuant to ITB Clause 20.

22.3 Bids (and modifications sent pursuant to ITB Clause 21.2) that are not opened and read out at bid opening shall not be considered further for evaluation, irrespective of the circumstances. Withdrawn bids will be returned unopened to the bidders.

22.4 The Procuring agency will prepare minutes of the bid opening.

23. Clarification of Bids

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

24. Preliminary Examination

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

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

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

24.4 Prior to the detailed evaluation, pursuant to ITB Clause 25 the Procuring agency will determine the substantial responsiveness of each bid to the bidding documents. For purposes of these Clauses, a substantially responsive bid is one which conforms to all the terms and conditions of the bidding documents without material deviations. Deviations from, or objections or reservations to critical provisions, **such as** those concerning Bid Security (ITB Clause 15), Applicable Law (GCC Clause 30), and Taxes and Duties (GCC Clause 32), will be deemed to be a material deviation. The Procuring agency's determination of a bid's responsiveness is to be based on the contents of the bid itself without recourse to extrinsic evidence.

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

25. Evaluation and Comparison of Bids

25.1 The Procuring agency will evaluate and compare the bids which have been determined to be substantially responsive, pursuant to ITB Clause 24.

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

25.3 The Procuring agency's evaluation of a bid will take into account, in addition to the bid price quoted in accordance with ITB Clause 11.2, one or more of the following factors as specified in the Bid Data Sheet, and quantified in ITB Clause 25.4:

(a) incidental costs

(b) delivery schedule offered in the bid;

(c) deviations in payment schedule from that specified in the Special Conditions of Contract;

(d) the cost of components, mandatory spare parts, and service;

(e) the availability Procuring agency of spare parts and after-sales services for the equipment offered in the bid;

(f) the projected operating and maintenance costs during the life of the equipment;

(g) the performance and productivity of the equipment offered; and/or

(h) other specific criteria indicated in the Bid Data Sheet and/or in the Technical Specifications.

25.4 For factors retained in the Bid Data Sheet pursuant to ITB 25.3, one or more of the following quantification methods will be applied, as detailed in the Bid Data Sheet:

(a) Incidental costs provided by the bidder will be added by Procuring agency to the delivered duty paid (DDP) price at

the final destination.

(b) *Delivery schedule.*

(i) The Procuring agency requires that the goods under the Invitation for Bids shall be delivered at the time specified in the Schedule of Requirements which will be treated as the base, a delivery "adjustment" will be calculated for bids by applying a percentage, specified in the Bid Data Sheet, of the DDP price for each week of delay beyond the base, and this will be added to the bid price for evaluation. No credit shall be given to early delivery.

or

(ii) The goods covered under this invitation are required to be delivered (shipped) within an acceptable range of weeks specified in the Schedule of Requirement. No credit will be given to earlier deliveries, and bids offering delivery beyond this range will be treated as nonresponsive. Within this acceptable range, an adjustment per week, as specified in the Bid Data Sheet, will be added for evaluation to the bid price of bids offering deliveries later than the earliest delivery period specified in the Schedule of Requirements.

or

(iii) The goods covered under this invitation are required to be delivered in partial shipments, as specified in the Schedule of Requirements. Bids offering deliveries earlier or later than the specified deliveries will be adjusted in the evaluation by adding to the bid price a factor equal to a percentage, specified in the Bid Data Sheet, of DDP price per week of variation from the specified delivery schedule.

(c) *Deviation in payment schedule.*

(i) Bidders shall state their bid price for the payment schedule outlined in the SCC. Bids will be evaluated on the basis of this base price. Bidders are, however, permitted to state an alternative payment schedule and indicate the reduction in bid price they wish to offer for such alternative payment schedule. The Procuring agency may consider the alternative payment schedule offered by the selected Bidder.

or

(ii) The SCC stipulates the payment schedule offered by

the Procuring agency. If a bid deviates from the schedule and if such deviation is considered acceptable to the Procuring agency, the bid will be evaluated by calculating interest earned for any earlier payments involved in the terms outlined in the bid as compared with those stipulated in this invitation, at the rate per annum specified in the Bid Data Sheet.

(d) *Cost of spare parts.*

(i) The list of items and quantities of major assemblies, components, and selected spare parts, likely to be required during the initial period of operation specified in the Bid Data Sheet, is annexed to the Technical Specifications. The total cost of these items, at the unit prices quoted in each bid, will be added to the bid price.

or

(ii) The Procuring agency will draw up a list of high-usage and high-value items of components and spare parts, along with estimated quantities of usage in the initial period of operation specified in the Bid Data Sheet. The total cost of these items and quantities will be computed from spare parts unit prices submitted by the Bidder and added to the bid price.

or

(iii) The Procuring agency will estimate the cost of spare parts usage in the initial period of operation specified in the Bid Data Sheet, based on information furnished by each Bidder, as well as on past experience of the Procuring agency or other procuring agencies in similar situations. Such costs shall be added to the bid price for evaluation.

(e) *Spare parts and after sales service facilities in the Procuring agency's country.*

The cost to the Procuring agency of establishing the minimum service facilities and parts inventories, as outlined in the Bid Data Sheet or elsewhere in the bidding documents, if quoted separately, shall be added to the bid price.

(f) *Operating and maintenance costs.*

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

(g) *Performance and productivity of the equipment.*

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

or

(ii) Goods offered shall have a minimum productivity specified under the relevant provision in the Technical Specifications to be considered responsive. Evaluation shall be based on the cost per unit of the actual productivity of goods offered in the bid, and adjustment will be added to the bid price using the methodology specified in the Bid Data Sheet or in the Technical Specifications.

(h) *Specific additional criteria indicated in the Bid Data Sheet and/or in the Technical Specifications.*

The relevant evaluation method shall be detailed in the Bid Data Sheet and/or in the Technical Specifications.

Alternative 25.4 Merit Point System:

The following merit point system for weighing evaluation factors can be applied if none of the evaluation methods listed in 25.4 above has been retained in the Bid Data Sheet. The number of points allocated to each factor shall be specified in the Bid Data Sheet.

[In the Bid Data Sheet, choose from the range of]

Evaluated price of the goods	60 to 90
Cost of common list spare parts	0 to 20
Technical features, and maintenance and operating costs	0 to 20
Availability of service and spare parts	0 to 20
Standardization	0 to 20
Total	100

The bid scoring the highest number of points will be deemed to be the most advantageous bid.

26. Contacting the Procuring agency

26.1 Subject to ITB Clause 23, no Bidder shall contact the Procuring agency on any matter relating to its bid, from the time of the bid opening to the time the contract is awarded. If the Bidder wishes to bring additional information to the notice of the Procuring agency, it should do so in writing.

26.2 Any effort by a Bidder to influence the Procuring agency in its decisions on bid evaluation, bid comparison, or contract award may result in the rejection of the Bidder's bid.

F. Award of Contract

27. Post-qualification

27.1 In the absence of prequalification, the Procuring agency will determine to its satisfaction whether the Bidder that is selected as having submitted the most advantageous responsive bid is qualified to perform the contract satisfactorily, in accordance with the criteria listed in ITB Clause 13.3.

27.2 The determination will take into account the Bidder's financial, technical, and production capabilities. It will be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB Clause 13.3, as well as such other information as the Procuring agency deems necessary and appropriate.

27.3 An affirmative determination will be a prerequisite for award of the contract to the Bidder. A negative determination will result in rejection of the Bidder's bid, in which event the Procuring agency will proceed to the next most advantageous bid to make a similar determination of that Bidder's capabilities to perform satisfactorily.

28. Award Criteria

28.1 Subject to ITB Clause 30, the Procuring agency will award the contract to the successful Bidder whose bid has been determined to be substantially responsive and has been determined to be the most advantageous bid, provided further that the Bidder is

determined to be qualified to perform the contract satisfactorily.

29. Procuring agency's Right to Vary Quantities at Time of Award

29.1 The Procuring agency reserves the right at the time of contract award to increase or decrease, by the percentage indicated in the Bid Data Sheet, the quantity of goods and services originally specified in the Schedule of Requirements without any change in unit price or other terms and conditions.

30. Procuring agency's Right to Accept any Bid and to Reject any or All Bids

30.1 The Procuring agency reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to contract award, without thereby incurring any liability to the affected Bidder or bidders or any obligation to inform the affected Bidder or bidders of the grounds for the Procuring agency's action.

31. Notification of Award

31.1 Prior to the expiration of the period of bid validity, the Procuring agency will notify the successful Bidder in writing by registered letter or by cable, to be confirmed in writing by registered letter, that its bid has been accepted.

31.2 The notification of award will constitute the formation of the Contract.

31.3 Upon the successful Bidder's furnishing of the performance security pursuant to ITB Clause 33, the Procuring agency will promptly notify each unsuccessful Bidder and will discharge its bid security, pursuant to ITB Clause 15.

32. Signing of Contract

32.1 At the same time as the Procuring agency notifies the successful Bidder that its bid has been accepted, the Procuring agency will send the Bidder the Contract Form provided in the bidding documents, incorporating all agreements between the parties.

32.2 Within thirty (30) days of receipt of the Contract Form, the successful Bidder shall sign and date the contract and return it to the Procuring agency.

33 Performance Security

33.1 Within twenty (20) days of the receipt of notification of award from the Procuring agency, the successful Bidder shall furnish the performance security in accordance with the Conditions of Contract, in the Performance Security Form provided in the bidding documents, or in another form acceptable to the Procuring agency.

33.2 Failure of the successful Bidder to comply with the requirement of ITB Clause 32 or ITB Clause 33.1 shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid

security, in which event the Procuring agency may make the award to the next most advantageous bidder or call for new bids.

34. Corrupt or Fraudulent Practices

34.1 The Government of Sindh requires that Procuring agency's (including beneficiaries of donor agencies' loans), as well as Bidders/Suppliers/Contractors under Government-financed contracts, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, the SPPRA, in accordance with the SPP Act, 2009 and Rules made thereunder:

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

(i) "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; and

(ii) "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;

(b) will 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;

(c) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a Government-financed contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, a Government-financed contract.

34.2 Furthermore, Bidders shall be aware of the provision stated in sub-clause 5.4 and sub-clause 24.1 of the General Conditions of Contract.

Part One - Section II.
General Conditions of Contract

Table of Clauses

General Conditions of Contract

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 all of the equipment, machinery, and/or other materials 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 the Goods, such as transportation and insurance, and any other incidental services, such as installation, commissioning, provision of technical assistance, training, and other such obligations of the Supplier covered under the Contract.

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

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

(g) "The Procuring agency" means the organization purchasing the Goods, as named in SCC.

(h) "The Procuring agency's country" is the country named in SCC.

(i) "The Supplier" means the individual or firm supplying the Goods and Services under this Contract.

(j) "The Project Site," where applicable, means the place or places named in SCC.

(k) "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 All Goods and Services supplied under the Contract shall have their origin in the countries and territories eligible under the rules and `further elaborated in the SCC.

3.2 For purposes of this Clause, "origin" means the place where the Goods were mined, grown, or produced, or from which the Services are supplied. Goods are produced when, through manufacturing, processing, or substantial and major assembly of components, a commercially recognized new product results that is substantially different in basic characteristics or in purpose or utility from its components.

3.3 The origin of Goods and Services is distinct from the nationality of the Supplier.

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4.1 The Goods supplied under this Contract shall conform to the standards mentioned in the Technical Specifications, and, when no applicable standard is mentioned, to the authoritative standards appropriate to the Goods' country of origin. Such standards shall be the latest issued by the concerned institution.

5. Use of Contract Documents and Information; Inspection and Audit by the Government

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.

5.4 The Supplier shall permit the Procuring agency to inspect the Supplier's accounts and records relating to the performance of the Supplier and to have them audited by auditors appointed by the procuring agency, if so required.

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 Procuring agency's country.

7. Performance Security

7.1 Within twenty (20) days of receipt of the notification of Contract award, the successful Bidder shall furnish to the Procuring agency the performance security in the amount specified in SCC.

7.2 The proceeds of the performance security shall be payable to the Procuring agency as compensation for any loss resulting from the Supplier's failure to complete its obligations under the Contract.

7.3 The performance security shall be denominated in the currency of the Contract acceptable to the Procuring agency and shall be in one of the following forms:

(a) a bank guarantee or an irrevocable letter of credit issued by a reputable bank located in the Procuring agency's country, in the form provided in the bidding documents or another form acceptable to the Procuring agency; or

(b) a cashier's or certified check.

7.4 The performance security will be discharged by the Procuring agency and returned to the Supplier not later than thirty (30) days following the date of completion of the Supplier's performance obligations under the Contract, including any warranty obligations, unless specified otherwise in SCC.

8. Inspections and Tests

8.1 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. SCC and the Technical Specifications shall specify what inspections and tests the Procuring agency requires and where they are to be conducted. The Procuring agency shall notify the Supplier in writing, in a timely manner, of the identity of any representatives retained for these purposes.

8.2 The inspections and tests may be conducted on the premises of the Supplier or its subcontractor(s), at point of delivery, and/or at

the Goods' final destination. If conducted on the premises of the Supplier or its subcontractor(s), all reasonable facilities and assistance, including access to drawings and production data, shall be furnished to the inspectors at no charge to the Procuring agency.

8.3 Should any inspected or tested Goods fail to conform to the Specifications, the Procuring agency may reject the Goods, and the Supplier shall either replace the rejected Goods or make alterations necessary to meet specification requirements free of cost to the Procuring agency.

8.4 The Procuring agency's right to inspect, test and, where necessary, reject the Goods after the Goods' arrival in the Procuring agency's country shall in no way be limited or waived by reason of the Goods having previously been inspected, tested, and passed by the Procuring agency or its representative prior to the Goods' shipment from the country of origin.

8.5 Nothing in GCC Clause 8 shall in any way release the Supplier from any warranty or other obligations under this Contract.

9. Packing

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

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

10. Delivery and Documents

10.1 Delivery of the Goods shall be made by the Supplier in accordance with the terms specified in the Schedule of Requirements. The details of shipping and/or other documents to be furnished by the Supplier are specified in SCC.

10.2 Documents to be submitted by the Supplier are specified in SCC.

11. Insurance

11.1 The Goods supplied under the Contract shall be delivered duty paid (DDP) under which risk is transferred to the buyer after having been delivered, hence insurance coverage is sellers responsibility.

12. Transportation

12.1 The Supplier is required under the Contact to transport the Goods to a specified place of destination within the Procuring agency's country, transport to such place of destination in the Procuring agency's country, including insurance and storage, as shall be specified in the Contract, shall be arranged by the Supplier, and related costs shall be included in the Contract Price.

13. Incidental Services

13.1 The Supplier may be required to provide any or all of the following services, including additional services, if any, specified in SCC:

(a) performance or supervision of on-site assembly and/or start-up of the supplied Goods;

(b) furnishing of tools required for assembly and/or maintenance of the supplied Goods;

(c) furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied Goods;

(d) performance or supervision or maintenance and/or repair of the supplied Goods, for a period of time agreed by the parties, provided that this service shall not relieve the Supplier of any warranty obligations under this Contract; and

(e) training of the Procuring agency's personnel, at the Supplier's plant and/or on-site, in assembly, start-up, operation, maintenance, and/or repair of the supplied Goods.

13.2 Prices charged by the Supplier for incidental services, if not included in the Contract Price for the Goods, shall be agreed upon in advance by the parties and shall not exceed the prevailing rates charged for other parties by the Supplier for similar services.

14. Spare Parts

14.1 As specified in SCC, the Supplier may be required to provide any or all of the following materials, notifications, and information pertaining to spare parts manufactured or distributed by the Supplier:

(a) such spare parts as the Procuring agency may elect to purchase from the Supplier, provided that this election shall not relieve the Supplier of any warranty obligations under the Contract; and

(b) in the event of termination of production of the spare parts:

(i) advance notification to the Procuring agency of the pending termination, in sufficient time to permit the Procuring agency to procure needed requirements; and

(ii) following such termination, furnishing at no cost to the Procuring agency, the blueprints, drawings, and specifications of the spare parts, if requested.

15. Warranty

15.1 The Supplier warrants that the Goods supplied under the Contract are new, unused, of the most recent or current models, and that they incorporate all recent improvements in design and materials unless provided otherwise in the Contract. The Supplier further warrants that all Goods supplied under this Contract shall have no defect, arising from design, materials, or workmanship (except when the design and/or material is required by the Procuring agency's specifications) or from any act or omission of the Supplier, that may develop under normal use of the supplied Goods in the conditions prevailing in the country of final destination.

15.2 This warranty shall remain valid for twelve (12) months after the Goods, or any portion thereof as the case may be, have been delivered to and accepted at the final destination indicated in the Contract, or for eighteen (18) months after the date of shipment from the port or place of loading in the source country, whichever period concludes earlier, unless specified otherwise in SCC.

15.3 The Procuring agency shall promptly notify the Supplier in writing of any claims arising under this warranty.

15.4 Upon receipt of such notice, the Supplier shall, within the period specified in SCC and with all reasonable speed, repair or replace the defective Goods or parts thereof, without costs to the Procuring agency.

15.5 If the Supplier, having been notified, fails to remedy the defect(s)

within the period specified in SCC, within a reasonable period, the Procuring agency may proceed to take such remedial action as may be necessary, at the Supplier's risk and expense and without prejudice to any other rights which the Procuring agency may have against the Supplier under the Contract.

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 The Supplier's request(s) for payment shall be made to the Procuring agency in writing, accompanied by an invoice describing, as appropriate, the Goods delivered and Services performed, and by documents submitted pursuant to GCC Clause 10, and upon fulfillment of other obligations stipulated in the Contract.

16.3 Payments shall be made promptly by the Procuring agency, but in no case later than sixty (60) days after submission of an invoice or claim by the Supplier.

16.4 The currency of payment is Pak. Rupees.

17. Prices

17.1 Prices charged by the Supplier for Goods delivered and Services performed under the Contract shall not vary from the prices quoted by the Supplier in its bid, with the exception of any price adjustments authorized in SCC or in the Procuring agency's request for bid validity extension, as the case may be.

18. Change Orders

18.1 The Procuring agency may at any time, by a written order given to the Supplier pursuant to GCC Clause 31, make changes within the general scope of the Contract in any one or more of the following:

(a) drawings, designs, or specifications, where Goods to be furnished under the Contract are to be specifically manufactured for the Procuring agency;
(b) the method of shipment or packing;

(c) the place of delivery; and/or

(d) the Services to be provided by the Supplier.

18.2 If any such change causes an increase or decrease in the cost of, or the time required for, the Supplier's performance of any provisions under the Contract, an equitable adjustment shall be

made in the Contract Price or delivery schedule, or both, and the Contract shall accordingly be amended. Any claims by the Supplier for adjustment under this clause must be asserted within thirty (30) days from the date of the Supplier's receipt of the Procuring agency's change order.

19. Contract Amendments

19.1 Subject to GCC Clause 18, no variation in or modification of the terms of the Contract shall be made except by written amendment signed by the parties.

20. Assignment

20.1 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.

21. Subcontracts

21.1 The Supplier shall notify the Procuring agency in writing of all subcontracts awarded under this Contract if not already specified in the bid. Such notification, in the original bid or later, shall not relieve the Supplier from any liability or obligation under the Contract.

21.2 Subcontracts must comply with the provisions of GCC Clause 3.

22. Delays in the Supplier's Performance

22.1 Delivery of the Goods and performance of Services shall be made by the Supplier in accordance with the time schedule prescribed by the Procuring agency in the Schedule of Requirements.

22.2 If at any time during performance of the Contract, the Supplier or its subcontractor(s) should encounter conditions impeding timely delivery of the Goods and performance of Services, 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.

22.3 Except as provided under GCC Clause 25, a delay by the Supplier in the performance of its delivery obligations shall render the Supplier liable to the imposition of liquidated damages pursuant to GCC Clause 23, unless an extension of time is agreed upon pursuant to GCC Clause 22.2 without the application of liquidated damages.

23. Liquidated

23.1 Subject to GCC Clause 25, if the Supplier fails to deliver any or

Damages

all of the Goods or to perform the Services within the period(s) specified in the Contract, the Procuring agency shall, without prejudice to its other remedies under the Contract, deduct from the Contract Price, as liquidated damages, a sum equivalent to the percentage specified in SCC of the delivered price of the delayed Goods or unperformed Services for each week or part thereof of delay until actual delivery or performance, up to a maximum deduction of the percentage specified in SCC. Once the maximum is reached, the Procuring agency may consider termination of the Contract pursuant to GCC Clause 24.

24. Termination for Default

24.1 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 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 22; 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 Borrower, 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 Borrower of the benefits of free and open competition.

24.2 In the event the Procuring agency terminates the Contract in whole or in part, pursuant to GCC Clause 24.1, the Procuring agency may procure, upon such terms and in such manner as it deems appropriate, Goods or Services similar to those

undelivered, and the Supplier shall be liable to the Procuring agency for any excess costs for such similar Goods or Services. However, the Supplier shall continue performance of the Contract to the extent not terminated.

25. Force Majeure

25.1 Notwithstanding the provisions of GCC Clauses 22, 23, and 24, the Supplier shall not be liable for forfeiture of its performance security, liquidated damages, or termination for default if and to the extent that its delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure.

25.2 For purposes of this clause, "Force Majeure" means an event beyond the control of the Supplier and not involving the Supplier's fault or negligence and not foreseeable. Such events may include, but are not restricted to, acts of the Procuring agency in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions, and freight embargoes.

25.3 If a Force Majeure situation arises, the Supplier shall promptly notify the Procuring agency in writing of such condition and the cause thereof. 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 all reasonable alternative means for performance not prevented by the Force Majeure event.

26. Termination for Insolvency

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

27. Termination for Convenience

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

27.2 The Goods that are complete and ready for shipment within thirty (30) days after the Supplier's receipt of notice of termination shall be accepted by the Procuring agency at the

Contract terms and prices. For the remaining Goods, the Procuring agency may elect:

(a) to have any portion completed and delivered at the Contract terms and prices; and/or

(b) to cancel the remainder and pay to the Supplier an agreed amount for partially completed Goods and Services and for materials and parts previously procured by the Supplier.

28. Resolution of Disputes

28.1 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.

28.2 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 for resolution to the formal mechanisms specified in SCC. These mechanisms may include, but are not restricted to, conciliation mediated by a third party, adjudication in an agreed manner and/or arbitration.

29. Governing Language

29.1 The Contract shall be written in the language specified in SCC. Subject to GCC Clause 30, 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 the same language.

30. Applicable Law

30.1 The Contract shall be interpreted in accordance with the laws of the Procuring agency's country, unless otherwise specified in SCC.

31. Notices

31.1 Any notice given by one party to the other pursuant to this Contract shall be sent to the other party in writing or by cable, telex, or facsimile and confirmed in writing to the other party's address specified in SCC.

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

32. Taxes and Duties

32.1 Supplier shall be entirely responsible for all taxes, duties, license fees, etc., incurred until delivery of the contracted Goods to the Procuring agency.

Notes on the Instructions to Bidders

This section of the bidding documents provides the information necessary for bidders to prepare responsive bids, in accordance with the requirements of the Procuring agency. It also provides information on bid submission, opening, and evaluation, and on the award of contract.

Part One Section I contains provisions that are to be used unchanged. Part Two Section II consists of provisions that supplement, amend, or specify in detail information or requirements included in Part One Section I and which are specific to each procurement.

Matters governing the performance of the Supplier, payments under the contract, or matters affecting the risks, rights, and obligations of the parties under the contract are not normally included in this section, but rather under Part one Section II, General Conditions of Contract, and/or Part Two Section III, Special Conditions of Contract. If duplication of a subject is inevitable in the other sections of the document prepared by the Procuring agency, care must be exercised to avoid contradictions between clauses dealing with the same matter.

These Instructions to Bidders will not be part of the contract.

Notes on the General Conditions of Contract

The General Conditions of Contract in Part One Section II, read in conjunction with the Special Conditions of Contract in Part Two Section III and other documents listed therein, should be a complete document expressing all the rights and obligations of the parties.

The General Conditions of Contract herein shall not be altered. Any changes and complementary information, which may be needed, shall be introduced only through the Special Conditions of Contract in Part Two Section III.

Sindh Public Procurement Regulatory Authority

Bidding Documents

For

National Competitive Bidding

Procurement of Goods

PART TWO (PROCUREMENT SPECIFIC PROVISIONS)

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

Preface

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

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

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

(a) Specific details, such as the "name of the Procuring agency" and "address for bid submission," should be furnished in the Invitation for Bids, in the Bid Data Sheet, and in the Special Conditions of Contract. The final documents should contain neither blank spaces nor options.

(b) Amendments, if any, to the Instructions to Bidders and to the General Conditions of Contract should be made through the Bid Data Sheet and the Special Conditions of Contract, respectively.

(c) Footnotes or notes in italics included in the Invitation for Bids, Bid Data Sheet, Special Conditions of Contract, and in the Schedule of Requirements are not part of the text of the document, although they contain instructions that the Procuring agency should strictly follow. The final document should contain no footnotes.

(d) The criteria for bid evaluation and the various methods of evaluation in the Instructions to Bidders (Clauses 25.3 and 25.4, respectively) should be carefully reviewed. Only those that are selected to be used for the procurement in question should be retained and expanded, as required, in the Bid Data Sheet or in the Technical Specifications, as appropriate. The criteria that are not applicable should be deleted from the Bid Data Sheet.

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

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

Table of Contents - Part Two

Part Two
Section I. Invitation for Bids

Notes on the Invitation for Bids

The Invitation for Bids (IFB) shall be issued as an advertisement in at least three newspaper of general circulation in the Province of Sindh or Authorities web site as the case may be, allowing at least fifteen days for NCB and forty five days(45) ICB for bid preparation and submission ;

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

The Invitation for Bids should be incorporated into the bidding documents. The information contained in the Invitation for Bids must conform to the bidding documents and in particular to the relevant information in the Bid Data Sheet.

Invitation for Bids

Date: *[date of issuance of IFB]* _____

IFB N^{o}: _____

1. The Executive Director / DG, Sindh Institute of Animal Health, Karachi has received an allocation from the Public Fund in Pak rupees under ADP scheme No.1509 namely **"Gap Analysis and Compliance of DRAP at Sindh Institute of Animal Health Karachi"** during financial year 2025-26. It is intended that part of the proceeds of this allocated fund will be applied to eligible payments under the contract.

2. The Sindh Institute of Animal Health, Karachi now invites bids from eligible bidders for the supply of Plant & Machinery items.

3. Interested eligible bidders may obtain further information by downloading the bidding documents from EPADS portal https://sindh.eprocure.gov.pk

4. The bidding document may be purchased online by interested bidders on the submission of a written application on company letter head upon payment of a nonrefundable fee of Rs. 1,000 through pay order issued in favour of Sindh Institute of Animal Health, Karachi.

5. The provisions in the Instructions to Bidders and in the General Conditions of Contract are the provisions of the Sindh Public Procurement Ordinance and its Rules made thereunder which also conform to the requirements of the World Bank *Standard Bidding Documents: Procurement of Goods for National Competitive Bidding, Pakistan*, Part One.

6. Bids must be submit online on EPADS portal and hard copy must be delivered to the above office on or before **02:00 pm on 03.02.2026** and must be accompanied by a security deposit of Rs. 6,100,000 bid amount.

7. Bids will be opened in the presence of bidders' representatives who choose to attend at **02:30 PM on 03.02.2026** at the Committee Room of Sindh Institute of Animal Health at Animal Science Complex, Korangi, Karachi.

8. The bidders are requested to give their best and final prices as no negotiations are expected.

Section II. Bid Data Sheet

Notes on the Bid Data Sheet

Section II is intended to assist the Procuring agency in providing the specific information in relation to corresponding clauses in the Instructions to Bidders included in Part one Section I, and has to be prepared for each specific procurement.

The Procuring agency should specify in the Bid Data Sheet information and requirements specific to the circumstances of the Procuring agency, the processing of the procurement, the applicable rules regarding bid price and currency, and the bid evaluation criteria that will apply to the bids. In preparing Section II, the following aspects should be checked:

(a) Information that specifies and complements provisions of Part One Section I must be incorporated.

(b) Amendments and/or supplements, if any, to provisions of Part One Section I as necessitated by the circumstances of the specific procurement, must also be incorporated.

Bid Data Sheet

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

INTRODUCTION		
ITB 1.1	Name of Department of Government of Sindh	Livestock & Fisheries Department
ITB 1.2	Name of Project	ADP scheme No 1509 "**Gap Analysis and Compliance of DRAP at Sindh Institute of Animal Health Karachi**"
ITB 1.3	Name of Contract	**Procurement of Plant & Machinery**
ITB 1.4	Name of Procuring agency	Sindh Institute of Animal Health
ITB 1.5	Procuring agency's address, telephone:	Animal Science Complex, Korangi Karachi Telephone: 0213-5123347
ITB 1.6	Language of the bid	English
BID PRICE AND CURRENCY		
ITB 2.1	Bid Price Currency	The price quoted shall be in **PAK Rupees** inclusive of all taxes (present & future) duties and charges for packing, supply, marking, handling, installation and transportation etc.
ITB 2.2	Nature of Bid Price	The price shall be fixed
PREPARATION AND SUBMISSION OF BIDS		
ITB 5	Qualification requirements	**See annexure Bidders Qualification Criteria**
ITB 6	Amount of bid security	**Rs. 6,100,000**
ITB 7	Manner of bid security	The bid security shall be denominated in the currency of the bid: a) The bid security shall be called in the form of Bank Guarantee/Demand Draft/Pay order issued by a scheduled bank in Pakistan in favour of Sindh Institute of Animal Health, Karachi and have validity as per SPPRA Rules. b) The softcopy be uploaded at EPADS portal and original be submitted with the hard copy of proposal.

		c) Bid security shall release to the unsuccessful bidders once the contract has been signed with the successful bidder or the validity period has expired. d) The successful Bidder's bid security shall be discharged upon the Bidder signing the contract, and furnishing the performance security. e) The bid security may be forfeited: a) if a Bidder withdraws its bid during the period of bid validity or b) in the case of a successful Bidder, if the bidder fails: (i) to sign the contract in accordance or (ii) to furnish performance security
ITB 8	Bid validity period	90 days and extendable as per SPPRA Rules
ITB 9	Number of copies	Upload at EPADS portal and 01 Original hard copy must be submitted
ITB 11	Address for bid submission	Soft copy on EPADS portal and hard copy submitted at office of the Director General, Sindh Institute of Animal Health at Animal Science Complex, Korangi, Karachi
ITB 12	IFB title and number	**Procurement of Plant & Machinery** **SIAH/ASC/ADP1509/mach/25-26**
ITB 13	Deadline for bid submission	**03.02.2026 at 02:00 PM**
ITB 14	Time, date, and place for bid opening	**03.02.2026 at 02:30 PM** Committee Room of Sindh Institute of Animal Health at Animal Science Complex, Korangi, Karachi.
BID EVALUATION		
ITB 15	Criteria for bid evaluation	**See annexure Bid Evaluation Criteria**
ITB 16	Details of evaluation method	Single Stage two envelope procedure
CONTRACT AWARD		
ITB 17	Amount of Performance Security	5% of Contract amount a) The performance security shall be submitted in the form of Bank Guarantee/Demand Draft/Pay order issued by a scheduled bank in Pakistan in favour of Sindh Institute of Animal Health, Karachi.

ITB 18	Percentage for quantity increase or decrease	As per SPPRA Rules

BIDDERS QUALIFICATION CRITERIA

The bidder qualification criteria shall consists of the following:

S. #	BIDDER ELIGIBILITY CRITERIA	Yes	No
MANDATORY REQUIREMENTS: (If the below mentioned listed mandatory documents are short in the bid, the bid will be straightaway rejected and bidder will be disqualified from tender for further processing).			
01.	Complete Company Profile (The profile must be configured according to the criteria of Serial No 1 to 23)		
02.	Copy of CNIC of Owners / Proprietors / CEO/ Board Members		
03.	Copy of FBR Registration Certificate bearing National Tax number (NTN) / GST		
	Registration with Pakistan Engineering Council in Category C-3 or above and at least in specialization codes ME-01, CE-10, BC01. The contractor should enclose PEC Registration Certificate, valid for the current year.		
04.	Copy of Latest Professional Tax Certificate (Sindh)		
05.	Copy of Active Tax Payer List (latest) for both Income Tax and Sales Tax		
	Copy of Tax Clearance Certificate upto date issued by the tax authorities		
06.	Copy of last three years submitted returns of: **i. Income Tax ii. Sales Tax**		
07.	The last three years annual turnover / amount of Annual Sales Value required should be **at least equal to or above** the estimated contract value. (Copy of last three financial years Bank statement and submit details on **Form 1**)		
08.	Copy of last three financial years Annual Audit Report conducted by International / Global Association of Audit / Chartered Accountancy Firm		
09.	Company / firm Profile and at least minimum ten years of establishment in doing business. Location of shop / office (Complete Address with, Phone, Fax, e-mail, Website address) of the Firm / Bidder. (PA have authority to visit during the process of tender)		
10.	**Experience:** • The firm has five years consequent supply experience to public sector / government institute in relevant nature of work (submit minimum five purchase orders / work completion certificate/ contract agreement for each year). • Minimum completion of two procurement contracts in same item / assignment in last three years in Sindh Institute of Animal Health Karachi and one contract in the last year. Chronology of Works/ Job Orders/ Award letters/ Contract Agreement/ Completion certificate and submit details on **Form 2).** • Submit details of Project in hands.		
11.	In case of manufacturer submit the proof of manufacturer along with details of manufacturing facility, site, trade license and experience (Procuring agency is authorized to conduct the physical inspection to review the authenticity of manufacturing facilities and submitted documents, if deemed necessary).		
12.	In the case of an applicant who does not manufacture the goods, the applicant should provide evidence of being duly authorized by the manufacturer, meeting the criteria under this document to supply the goods. (Submits authority on manufacture letter head must be submitted in original form).		

13.	The quoted items by the bidders must meet the technical specification of tender items as indicated in the Schedule of requirements (provide items Catalogue / Brochures / technical data sheet). Goods shall be evaluated as per the given Catalogue / Brochures / technical data sheet (having complete technical specifications of the offered good).		
14.	Tenders are required to be furnished with earnest money of Rs. 6,100,000 in the form of Bank guarantee/Demand Draft/Pay order from scheduled bank in Pakistan in favour of Sindh Institute of Animal Health, Karachi and have validity as per SPPRA Rules.		
15.	The Bidder should not have been barred / black listed by any of Provincial or Federal Govt. Deptt., Agency, Organization or autonomous body anywhere in Pakistan. (Submission of undertaking on Rs. 100/- legal stamp paper).		
16.	Client & contact details list of minimum 03 Institutes all over Pakistan must be provided by the bidder (proof must be attached with technical bid).		
17.	All items should be brand new and un-used and all proposed items must have manufacturer standard warranty.		
18.	Tender Document and all other related documents submitted by the bidder are duly signed and stamped each page by the bidder. An affidavit to the effect that all documents / particulars / information given with technical proposal are true.		
19.	An affidavit to the effect that the applicant has never indulged in corrupt, fraudulent or collusive practice for procuring contracts. An affidavit to the effect that the firm is not presently involved nor has been in the past in litigation with its employers. Should this be otherwise, the applicant must provide such details.		
20.	Alternate & conditional offer shall not be allowed.		

Note:

- The above mentioned criteria are mandatory for bidder's qualification; those who do not qualify or not fulfilled the above technical criteria the bids will be rejected and financial proposals will be returned unopened.
- Procuring Agency reserve the right to reject any bid if any one of the above-mentioned criteria is not fulfilled. Procuring agency shall disqualify the applicant at any stage, if it finds that the information submitted for qualification was either significantly inaccurate or incomplete. Incomplete or lacking the required information proposal shall not be entertained and shall be liable to rejection.
- Bidders are advised that before filling the bidding document, all the pages of bidding documents should carefully be checked. If any page / paper of bidding document are left unchecked / unsigned / missing / incomplete the bid will be straightaway rejected.
- Rates quoted must be inclusive of all prevalent taxes, providing transportation, fixation and installation charges etc as no negotiation is expected.
- The prospective firm(s) must provide valid evidence against each above criteria, the Procuring agency reserves the right to cross verify or call any information / document if deemed necessary in original, in order to ensure reliability / authenticity of information provided by the bidder.

BID EVALUATION CRITERIA (TECHNICAL)

The Technical Proposal will be evaluated on the basis of the criteria as set out below:

Sr. #.	Description		Maximum Marks
1.	Number of Years of company establishment / Establishment of Year (Company Profile)	01 mark for each year	10
2.	Registration with relevant Government authorities (FBR / PEC / ISO certificate)	05 marks will be given for valid evidence are provided	05
3.	Registration with Pakistan Engineering Council in Category C-3 or above and at least in specialization codes ME-01, CE-10, BC01. The contractor should enclose PEC Registration Certificate, valid for the current year.	02 marks will be given for valid evidence are provided	02
3.	Methodology and work plan	a. Submit proposed methodology of works, organizational chart, detailed approach to installation, testing, and commissioning. b. Demonstrated capability for similar works in accordance with the Work Performance Statement.	05

4.	**Experience with Government Organizations and authorities** The firm has five years consequent supply experience to public sector / government institute in relevant nature of work (submit minimum five purchase orders / work completion certificate/ contract agreement for each year).	03 marks will be given for each contract/ supplies completed in last five (05) years having value of PKR 05 Million each contract of similar size, type, nature, complexity. Copies of completion certificates from concerned authorities/ clients are mandatory to be submitted as evidence which may be verified. No marks will be given if no evidence or fake / invalid evidence is provided or less than 02 contracts attached of Rs. 2.5 Million each.	15
5.	Minimum completion of two procurement contracts in same item / assignment in last three years in Sindh Institute of Animal Health Karachi and one contract with in last year. Chronology of Works/ Job Orders/ Award letters /Contract Agreement/ Completion certificate and submit details on **Form 2).**	05 marks will be given for each contract/ supplies completed in last three years in Sindh Institute of Animal Health Karachi having value of PKR 05 Million each contract of similar size, type, nature, complexity. Copies of completion certificates from concerned authorities are mandatory to be submitted as evidence which may be verified. No marks will be given if no evidence or fake / invalid evidence is provided or less than 02 contracts attached of Rs. 01 Million each.	10
6.	Submit details of Project in hands	01 mark for each project of similar nature of work.	05
7.	Last three year submitted returns i. Income Tax ii. Sales Tax (GST)	01 mark will be given for each year of submitted return of Income Tax and GST.	03
8.	Submission of Active Tax payer list (latest) for both income Tax and Sales tax Submission of copy of latest Professional Tax Certificate	Proof being active tax payer and proof of latest Professional Tax Certificate (Sindh) must be submitted	03

	(Sindh)		
9.	The last three years annual turnover / amount of Annual Sales Value required should be at least equal to or above the estimated contract value. (Copy of last three financial years Bank statement and Account Maintenance Certificate and submit details on **Form 1**)	• 15 marks will be given if details of bank account (supported by Banks's Letter and Bank statement of last 03 years) are provided with account balance amounting to minimum of Rs. 15 Million to ascertain the cash flow of the bidder. • 10 marks will be given if bank account balance amounting to minimum of Rs. 10 Million (supported by Banks's Letter and Bank statement of last 03 years) are provided. • 5 marks will be given if bank account balance amounting to minimum of Rs.05 Million (supported by Banks's Letter and Bank statement of last 03 years) are provided. • No marks will be given if no account detail and relevant documents/evidence are not provided.	15
10.	Copy of last three financial years Annual Audit Report conducted by International / Global Association of Audit / Chartered Accountancy Firm	01 mark for each year	03
11.	Conformity to the purchaser specification/ sample examination, the quoted items by the bidders must meet the technical specification of tender as indicated in the Schedule of requirements.	Provide items Catalogue / Brochures / technical data sheet). Goods shall be evaluated as per the given Catalogue / Brochures / technical data sheet (having complete technical specifications of the offered good.	05

12.	In case of manufacturer submit the proof of manufacturer along with details of manufacturing facility, site, trade license and experience (Procuring agency is authorized to conduct the physical inspection to review the authenticity of manufacturing facilities and submitted documents, if deemed necessary).	In case of manufacturer submit the proof of manufacturer along with details of manufacturing facility.	05
	In the case of an applicant who does not manufacture the goods should provide evidence of being duly authorized by the manufacturer	The applicant should provide evidence of being duly authorized by the manufacturer, meeting the criteria under this document to supply the goods. (Submits authority on manufacture letter head must be submitted in original form).	
13.	Bidder should not have been barred / black listed	The Bidder should not have been barred / black listed by any of Provincial or Federal Govt. Deptt., Agency, Organization or autonomous body anywhere in Pakistan. (Submission of undertaking on Rs. 100/- legal stamp paper).	02
14.	Client & contact details list	Minimum 03 Institutes all over Pakistan must be provided by the bidder (proof must be attached with technical bid).	03
15.	Tender Document and all other related documents submitted by the bidder are duly signed and stamped each page by the bidder.	An affidavit to the effect that all documents / particulars / information given with technical proposal are true	02

16.	An affidavit to the effect that the applicant has never indulged in corrupt, fraudulent or collusive practice for procuring contracts. An affidavit to the effect that the firm is not presently involved nor has been in the past in litigation with its employers. Should this be otherwise, the applicant must provide such details.	Submission of undertaking on Rs. 100/- legal stamp paper	02
17.	Project Schedule & Service Management Plan	Installation schedule (e.g., Bar Chart / Gantt Chart) a plan outlining response times, preventative maintenance schedules, and staffing.	05
TOTAL MARKS			**100**

i. The firms / bidders are required to submit their Technical and Financial proposals on EPADS Portal and hard copy in one envelope containing Technical information of bid shall be clearly marked **"Technical Bid"** the second envelope containing the Bid Price shall be clearly marked **"Financial Bid"** and should be reach at office of the Director general, Sindh Institute of Animal health Karachi, Animal Science Complex Korangi, Karachi-74900 before the deadline of tender submission.

ii. Applications with required documents attached shall be evaluated on the score obtained and firms obtaining 75 marks and above score shall be technically qualified.

iii. The **"Financial Bid"** of only **"Technically Qualified Firms"** will be opened in presence of their respective representatives at the date and time to be determined and communicated later.

iv. The firm will be ranked with **80% weightage to technical score and 20% weightage to financial score**. The firm which attains the highest combined weighted technical and financial score according to the criteria set out in this bidding document would be selected for the assignments.

v. The applications of those firms including their subsidiaries and subcontractor who are blacklisted by any government department or by any of International Donor Agency like IFC, World Bank etc shall be rejected without detailed evaluation. The applicant is required to submit undertaking on judicial paper that he or any of his associate / manufacturer / supplier / subcontractor is not in the list of black listed firms of the above mentioned departments or financing institutions, the undertaking should be duly notarized.

vi. Any other pertinent information in support to this bidding should also be furnished.

vii. Procuring agency shall disqualify the applicant at any stage, if it finds that the information submitted for qualification was either significantly inaccurate or incomplete.

viii. Incomplete or lacking the required information proposal shall not be entertained and shall be liable to rejection.

The Minimum Technical score (St) required to pass is 75 Marks.

The technical score shall have 80% and Financial Bid have 20% weightage for weighted average scores. The Bid obtaining maximum combined score shall be declared as the most advantageous responsive Bid and the firm offering the Best Evaluated Bid shall be declared as the successful Bidder and issued Letter of Acceptance, containing invitation for contract. Any factor having a bearing on the quoted price shall not be subject to negotiations.

- The procuring agency reserves the right to evaluate and compare the bids on itemized basis OR on the basis of a group of similar nature goods OR goods compatible with each other.
- The above merit point system for weighing evaluation factors/criteria will be applied for technical proposals.
- Bidders achieving minimum 75 marks will be considered only for further process. Documentary evidence must be attached in support of each parameter.
- The lowest evaluated Financial Proposal (Fm) will be given the maximum financial score (Sf) of 100 points.
- Proposals will be ranked according to their combined technical (St) and financial (Sf) scores using the weights (T = the weight given to the Technical Proposal; P = the weight given to the Financial Proposal; T + P = 1) and for calculation of combined score S = St x T% + Sf x P%. The firm achieving the highest combined technical and financial score will be declared as most advantageous responsive Bid.
- The Contract will be awarded to the most advantageous responsive firm whose product ranks highest in the Combined Evaluation scoring calculated through the Marks awarded to Technical Proposal and Financial Proposal as stated in this Bidding Documents.

GENERAL CONDITIONS:

- Major features of offered item should meet tender specifications as indicated in schedule of requirements.
- Must be fulfilled the bidders eligibility criteria.
- Bids must be accompanied with Bid Security of Rs. 2,250,000 in form of Bank guarantee/Demand Draft/Pay order from scheduled bank in Pakistan in favour of Sindh Institute of Animal Health Karachi and have validity as per SPPRA Rules.
- Alternate or conditional bid cannot be accepted.
- Bid must be submitted on EPADS Portal electronically and hard copy in sealed envelope to the office of the Director general, Sindh Institute of Animal Health Karachi.
- Bids should be submitted in conformity with Rule-46 sub rule (2) of Sindh Public Procurement Rules 2010 (and amended made therein) i.e. "**Procedure of open Competitive Bidding" "Single Stage- Two Envelop.**

FORM 1

AVERAGE ANNUAL TURNOVER / SALES VALUE

[The following table shall be filled in by the bidder]

Applicant Legal Name: _____

[insert full name]

ANNUAL TURNOVER / SALES DATA	
Year	**Amount & Currency**
[indicate year]	[insert amount and indicate currency]
Average annual turnover*	

* Average annual turnover calculated as total certified payments received for supplies in progress or completed.

Are the amount of Annual Sales Value should be **at least equal to or above** the estimated contract value (Submission of Audited Annual Reports and Bank Statements). Yes □ / No □

_____

Sign & Stamp of bidders

FORM 2

DETAILS OF SIMILAR CONTRACTS

[The following table shall be filled in by the bidder]

Applicant Legal Name:	_____ [insert full name]
Contract identification	[insert contract name and number]
Contract Award Date	
Contract Completion Date	
Role in Contract	[insert Importer / Manufacturer / Authorized Agent]
Brief description of contract	
Description of similarity of contract with said bid	
Total contract amount	[Total contract amount in local currency]
If partner in JV/Consortium of subcontractor specify participation In total contract amount	[insert percentage amount of bidder] [insert total amount of contract in local currency]
Procuring Agency name:	
Address of Procuring agency	
Telephone / Fax number	
Email Address	

_____
Sign & Stamp of bidders

Section III. Special Conditions of Contract

Notes on the Special Conditions of Contract

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

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

(a) Information that complements provisions of Part one Section II must be incorporated.

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

Table of Clauses

Special Conditions of Contract

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

1. Definitions (GCC Clause 1)

GCC 1.1 (g)—The Procuring agency is: AAP, Livestock

GCC 1.1 (h)—The Procuring agency's country is: Pakistan

GCC 1.1 (i)—The Supplier is:

Sample Provision

GCC 1.1 (j)—The Project Site is: *[if applicable]*

2. Country of Origin (GCC Clause 3)

All countries and territories as indicated in Part Two Section VI of the bidding documents, "Eligibility for the Provisions of Goods, Works, and Services in Government-Financed Procurement".

3. Performance Security (GCC Clause 7)

GCC 7.1 - The amount of performance security, as a percentage of the Contract Price, shall be: **5%** and the firm is required to furnish the Performance Security in form of bank guarantee/Demand Draft/Pay order in favour of Sindh Poultry Vaccine Centre, Karachi within twenty (20) days after receipt of notification of contract award.

GCC 7.4—After delivery and acceptance of the Goods, the performance security shall be reduced to two (2) percent of the Contract Price to cover the Supplier's warranty obligations in accordance with Clause GCC 15.2.

4. Inspections and Tests (GCC Clause 8)

GCC 8.6—Inspection and tests prior to shipment of Goods and at final acceptance are as follows:

5. Packing (GCC Clause 9)

Sample provision

GCC 9.3—The following SCC shall supplement GCC Clause 9.2:

6. Delivery and Documents (GCC Clause 10)

Sample provision (DDP terms)

GCC 10.3—Upon shipment, the Supplier shall notify the Procuring agency the full details of the shipment, including Contract number, description of Goods, quantity and usual transport document. The Supplier shall mail the following documents to the Procuring agency:

(i) copies of the Supplier's invoice showing Goods' description, quantity, unit price, and total amount;
(ii) original and two copies of the usual transport document (for example, a negotiable bill of lading, a non-negotiable sea waybill, an inland waterway document, an air waybill, a railway consignment note, a road consignment note, or a multimodal transport document) which the buyer may require to take the goods;
(iii) copies of the packing list identifying contents of each package;
(iv) insurance certificate;
(v) Manufacturer's or Supplier's warranty certificate;
(vi) inspection certificate, issued by the nominated inspection agency, and the Supplier's factory inspection report; and
(vii) certificate of origin.

7. Insurance (GCC Clause 11)

GCC 11.1— The Goods supplied under the Contract shall be delivered duty paid (DDP) under which risk is transferred to the buyer after having been delivered, hence insurance coverage is sellers responsibility. Since the Insurance is seller's responsibility they may arrange appropriate coverage.

8. Incidental Services (GCC Clause 13)

GCC 13.1—Incidental services to be provided are:

[Selected services covered under GCC Clause 13 and/or other should be specified with the desired features. The price quoted in the bid price or agreed with the selected Supplier shall be included in the Contract Price.]

9. Spare Parts (GCC Clause 14)

GCC 14.1—Additional spare parts requirements are:

Sample provision

GCC 14.1—Supplier shall carry sufficient inventories to assure ex-stock supply of consumable spares for the Goods. Other spare parts and components shall be supplied as promptly as possible, but in any case within six (6) months of placing the order and opening the letter of credit.

10. Warranty (GCC Clause 15)

Sample provision

GCC 15.2—In partial modification of the provisions, the warranty period shall be _____ hours of operation or _____ months from date of acceptance of the Goods or (_____) months from the date of shipment, whichever occurs earlier. The Supplier shall, in addition, comply with the performance and/or consumption guarantees specified under the Contract. If, for reasons attributable to the Supplier, these guarantees are not attained in whole or in part, the Supplier shall, at its discretion, either:

(a) make such changes, modifications, and/or additions to the Goods or any part thereof as may be necessary in order to attain the contractual guarantees specified in the Contract at its own cost and expense and to carry out further performance tests in accordance with SCC 4,

or

(b) pay liquidated damages to the Procuring agency with respect to the failure to meet the contractual guarantees. The rate of these liquidated damages shall be (_____).

[The rate should be higher than the adjustment rate used in the bid evaluation under ITB 25.4 (f) or (g).]

GCC 15.4 & 15.5—The period for correction of defects in the warranty period is:

11. Payment (GCC Clause 16)

Sample provision

GCC 16.1—The method and conditions of payment to be made to the Supplier under this Contract shall be as follows:

Payment for Goods supplied:

Payment shall be made in Pak. Rupees in the following manner:

(i) **Advance Payment:** Ten (10) percent of the Contract Price shall be paid within thirty (30) days of signing of the Contract, and upon submission of claim and a bank guarantee for equivalent amount valid until the Goods are delivered and in the form provided in the bidding documents or another form acceptable to the Procuring agency.

(ii) **On Shipment:** Eighty (80) percent of the Contract Price of the Goods shipped shall be paid through irrevocable confirmed letter of credit opened in favor of the Supplier in a bank in its country, upon submission of documents specified in GCC Clause 10.

(iii) **On Acceptance:** Ten (10) percent of the Contract Price of Goods received shall be paid within thirty (30) days of receipt of the Goods upon submission of claim supported by the acceptance certificate issued by the Procuring agency.

Payment of local currency portion shall be made in *PAK RUPEES* within thirty (30) days of presentation of claim supported by a certificate from the Procuring agency declaring that the Goods have been delivered and that all other contracted Services have been performed.

(iv) 100% of the Contract Price on complete delivery of store within thirty (30) days on submission of claim supported by acceptance certificate from procuring agency declaring Goods have been delivered and that all contracted services have been performed.

(v) Part payment on part supply may be allowed

12. Prices (GCC Clause 17)

Sample provision

GCC 17.1—Prices shall be adjusted in accordance with provisions in the Attachment to SCC.

*[To be inserted **only** if price is subject to adjustment.]*

13. Liquidated Damages (GCC Clause 23)

GCC 23.1—Applicable rate:

Maximum deduction:

[Applicable rate shall not exceed one-half (0.5) percent per week, and the maximum shall not exceed ten (10) percent of the Contract Price.]

14. Resolution of Disputes (GCC Clause 28)

GCC 28.3—The dispute resolution mechanism to be applied pursuant to GCC Clause 28.2 shall be as follows:

In the case of a dispute between the Procuring agency and the Supplier, the dispute shall be referred to adjudication or arbitration in accordance with the laws of the Procuring agency's country.

15. Governing Language (GCC Clause 29)

GCC 29.1—The Governing Language shall be: English

16. Applicable Law (GCC Clause 30)

GCC 30.1-The Contract shall be interpreted in accordance with the laws of Islamic Republic of Pakistan which includes the following legislation:

The Employment of Children (ECA) Act 1991
The Bonded Labour System (Abolition) Act of 1992
The Factories Act 1934

17. Notices (GCC Clause 31)

GCC 31.1—Procuring agency's address for notice purposes:

—Supplier's address for notice purposes:

Section VI. Sample Forms

Notes on the Sample Forms

The Bidder shall complete and submit with its bid the **Bid Form** and **Price Schedules** pursuant to ITB Clause 9 and in accordance with the requirements included in the bidding documents.

When requested in the Bid Data Sheet, the Bidder should provide the **Bid Security**, either in the form included hereafter or in another form acceptable to the Procuring agency, pursuant to ITB Clause 15.3.

The **Contract Form**, when it is finalized at the time of contract award, should incorporate any corrections or modifications to the accepted bid resulting from price corrections pursuant to ITB Clause 16.3 and GCC Clause 17, acceptable deviations (e.g., payment schedule pursuant to ITB Clause 25.4 (c), spare parts pursuant to ITB Clause 25.4 (d), or quantity variations pursuant to ITB Clause 29. The Price Schedule and Schedule of Requirements deemed to form part of the contract should be modified accordingly.

The **Performance Security** and **Bank Guarantee for Advance Payment** forms should not be completed by the bidders at the time of their bid preparation. Only the successful Bidder will be required to provide performance security and bank guarantee for advance payment in accordance with one of the forms indicated herein or in another form acceptable to the Procuring agency and pursuant to GCC Clause 7.3 and SCC 11, respectively.

The **Manufacturer's Authorization** form should be completed by the Manufacturer, as appropriate, pursuant to ITB Clause 13.3 (a).

Sample Forms

1. Bid Form and Price Schedules

Date: _____
IFB N^{o}: _____

To: [name and address of Procuring Agency]

Gentlemen and/or Ladies:

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

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

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

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

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

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

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

(if none, state "none")

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

Dated this _____ day of _____ 19_____.

_____ _____

[signature] *[in the capacity of]*

Duly authorized to sign Bid for and on behalf of _____

Price Schedule in Pak. Rupees

Name of Bidder _____. IFB Number _____. Page _ of ___.

1	2	3	4	5	6		8
Item	Description	Country of origin	Quantity	Unit price DDP named place	Sales Tax GST	Total DDP per item	Unit price of Delivered duty paid (DDP) to final destination plus price of other incidental services if required[3]

Signature of Bidder _____

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

[3] Must be included if required under ITB 11.2

2. Bid Security Form

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

KNOW ALL PEOPLE by these presents that WE *[name of bank]* of *[name of country]*, having our registered office at *[address of bank]* (hereinafter called "the Bank"), are bound unto *[name of Procuring agency]* (hereinafter called "the Procuring agency") in the sum of for which payment well and truly to be made to the said Procuring agency, the Bank binds itself, its successors, and assigns by these presents. Sealed with the Common Seal of the said Bank this _____ day of _____ 19____.

THE CONDITIONS of this obligation are:

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

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

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

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

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

_____

[signature of the bank]

3. Contract Form

THIS AGREEMENT made the _____ day of _____ 19_____ between *[name of Procuring Agency]* of *[country of Procuring agency]* (hereinafter called "the Procuring agency") of the one part and *[name of Supplier]* of *[city and country of Supplier]* (hereinafter called "the Supplier") of the other part:

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

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

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

2. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz.:
(a) the Bid Form and the Price Schedule submitted by the Bidder;
(b) the Schedule of Requirements;
(c) the Technical Specifications;
(d) the General Conditions of Contract;
(e) the Special Conditions of Contract; and
(f) the Procuring agency's Notification of Award.

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

4. The Procuring agency hereby covenants to pay the 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 the contract at the times and in the manner prescribed by the contract.

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

Signed, sealed, delivered by _____ the _____ (for the Procuring agency)

Signed, sealed, delivered by _____ the _____ (for the Supplier)

4. Performance Security Form

To: *[name of Procuring agency]*

WHEREAS *[name of Supplier]* (hereinafter called "the Supplier") has undertaken, in pursuance of Contract No. *[reference number of the contract]* dated _____ 19_____ to supply *[description of goods and services]* (hereinafter called "the Contract").

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

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

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

This guarantee is valid until the _____ day of _____19_____.

Signature and seal of the Guarantors

_____

[name of bank or financial institution]

_____

[address]

_____

[date]

5. Bank Guarantee for Advance Payment

To: *[name of Procuring agency]*

[name of Contract]

Gentlemen and/or Ladies:

In accordance with the payment provision included in the Special Conditions of Contract, which amends Clause 16 of the General Conditions of Contract to provide for advance payment, *[name and address of Supplier]* (hereinafter called "the Supplier") shall deposit with the Procuring agency a bank guarantee to guarantee its proper and faithful performance under the said Clause of the Contract in an amount of *[amount of guarantee in figures and words]*.

We, the *[bank or financial institution]*, as instructed by the Supplier, agree unconditionally and irrevocably to guarantee as primary obligator and not as surety merely, the payment to the Procuring agency on its first demand without whatsoever right of objection on our part and without its first claim to the Supplier, in the amount not exceeding *[amount of guarantee in figures and words]*.

We further agree that no change or addition to or other modification of the terms of the Contract to be performed thereunder or of any of the Contract documents which may be made between the Procuring agency and the Supplier, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition, or modification.

This guarantee shall remain valid and in full effect from the date of the advance payment received by the Supplier under the Contract until *[date]*.

Yours truly,

Signature and seal of the Guarantors

_____

[name of bank or financial institution]

_____

[address]

_____

[date]

6. Manufacturer's Authorization Form

[See Clause 13.3 (a) of the Instructions to Bidders.]

To: *[name of the Procuring agency]*

WHEREAS *[name of the Manufacturer]* who are established and reputable manufacturers of *[name and/or description of the goods]* having factories at *[address of factory]*

do hereby authorize *[name and address of Agent]* to submit a bid, and subsequently negotiate and sign the Contract with you against IFB No. *[reference of the Invitation to Bid]* for the above goods manufactured by us.

We hereby extend our full guarantee and warranty as per Clause 15 of the General Conditions of Contract for the goods offered for supply by the above firm against this Invitation for Bids.

_____

[signature for and on behalf of Manufacturer]

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

INTEGRITY PACT

DECLARATION OF FEES, COMMISSION AND BROKERAGE ETC.
PAYABLE BY THE SUPPLIERS OF GOODS, SERVICES & WORKS IN CONTRACTS

Contract Date:
Contract Value:
Contract Title:

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

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

[Name of Contractor] certifies that it has made and will make full disclosure of all agreements and arrangements with all persons in respect of or related to the transaction with GoS and has not taken any action or will not take any action to circumvent the above declaration, representation or warranty.

[Name of Contractor] accepts full responsibility and strict liability for making any false declaration, not making full disclosure, misrepresenting facts or taking any action likely to defeat the purpose of this declaration, representation and warranty. It agrees that any contract, right, interest, privilege or other obligation or benefit obtained or procured as aforesaid shall, without prejudice to any other rights and remedies available to GoS under any law, contract or other instrument, be voidable at the option of GoS.

Notwithstanding any rights and remedies exercised by GoS in this regard, *[Name of Contractor]* agrees to indemnify GoS for any loss or damage incurred by it on account of its corrupt business practices and further pay compensation to GoS in an amount equivalent to ten time the sum of any commission, gratification, bribe, finder's fee or kickback given by *[Name of Contractor]* 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 GoS.

CONTRACTOR **PROCURING AGENCY**

Section IV. Schedule of Requirements

Notes for Preparing the Schedule of Requirements

The Schedule of Requirements shall be included in the bidding documents by the Procuring agency, and shall cover, at a minimum, a description of the goods and services to be supplied and the delivery schedule.

The objective of the Schedule of Requirements is to provide sufficient information to enable bidders to prepare their bids efficiently and accurately, in particular, the Price Schedule, for which a form is provided in Section VI. In addition, the Schedule of Requirements, together with the Price Schedule, should serve as a basis in the event of quantity variation at the time of award of contract pursuant to ITB Clause 29.

The date or period for delivery should be carefully specified, taking the date prescribed herein from which the Procuring agency's delivery obligations start (i.e., notice of award, contract signature, opening or confirmation of the letter of credit).

SCHEDULE OF REQUIREMENTS / BOQ

DATA SHEET / ASSIGNMENT INFORMATION

PLANT & MACHINERY (HVAC)

TOTAL HVAC COST ESTIMATE FOR SIAH	
Type Name	**Cost (PKR)**
HVAC Cost for Killed Vaccine Unit	
HVAC Cost for Live Vaccine Unit Block A	
HVAC Cost for Live Vaccine Unit Block B	
HVAC Cost for LSD and Bacterin Unit	
Total Cost	

SCHEDULE OF REQUIREMENTS / BOQ
DATA SHEET / ASSIGNMENT INFORMATION
KILLED VACCINE UNIT

HVAC Works Killed Vaccine Unit Cost	
Type Name	**Cost (PKR)**
HVAC System Cost Estimate	
BMS for HVAC System Cost Estimate	
Electrical for HVAC System Cost Estimate	
Fire, CCTV, Data, Communication System Estimate	
Repair, Revalidation and Recommissioning of OLD HVAC System	
Total Cost (PKR)	

Subject:- Supply & Installation of HVAC System for Killed Vaccine Unint							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ITEM NO.	DESCRIPTION	QTY.	UNIT	MATERIAL		INSTALL. / LABOUR	
				UNIT RATE	AMOUNT	UNIT RATE	AMOUNT
				(Rs.)	(Rs.)	(Rs.)	(Rs.)
					(3) x (5)		(3) x (7)
	Supply and Installation of Dx Type Package Units as per provided equipment schedule						
1	a) AHU 12 TR 14.5	1	No.				
	b) AHU 13&14 TR 12.6	2	No.				
	c) AHU 15 TR 6.5	1	No.				
2	Supply and Installation of Ducted Inline Exhaust Fans with below specifications. Type :- Ducted Inline						
	a) Ex - 1 (500 cfm 1.5 inwg esp)	1	No.				
	b) Ex - 2 (1600 cfm 1.5 inwg esp)	1	No.				
	c) Ex - 3 (1600 cfm 1.5 inwg esp)	1	No.				
3	Relocation of AHU along including its bms, piping and electrical connections as per new design, complete in all respect.						
a	Place old AHU 1 in place of new AHU 1	1	No.				
b	Place old AHU 12 in place of new AHU 2	1	No.				
c	Place old AHU 3 in place of new AHU 3	1	No.				
d	Place old AHU 2 in place of new AHU 3	1	No.				
e	Place old AHU 2 in place of new AHU 4	1	No.				
f	Place old AHU 5 in place of new AHU 5	1	No.				
g	Place old AHU 6 in place of new AHU 9	1	No.				
h	Place old AHU 8 in place of new AHU 7	1	No.				
i	Place old AHU 7 in place of new AHU 8	1	No.				
j	Place old AHU 6 in place of new AHU 9	1	No.				
k	Place old AHU 11 in place of new AHU 10	1	No.				
l	Place old AHU 13 in place of new AHU 11	1	No.				
m	Place old AHU 4 in place of new AHU 16	1	No.				
n	Place old AHU 10 in place of new AHU 17	1	No.				
4	Supply and construct of RCC Foundation on proposed roof for new package units and modification in old foundation for placement of old ahu in new location as per site requirement, complete in all respect.	1	Job				
5	Transportation, Rigging and Shifting of new AHUs as per site requriement	1	Job				
6	Supply & Installation of Booster Fan 1 with H14 Hepa filter, 2200 cfm, static pressure as per filter requirement, box should be in double skin (For AHU 1)	1	No.				
7	Supply & Installation of Booster Fan 2 with 1000 cfm, 2.5 inwg static pressure, box should be in double skin. (For AHU 2)	1	No.				

8	Supply & Installation of Booster Fan 3 with 3.0 ton dx coil, H14 Filters, 2300 cfm, static pressure as per filter and coil requirement, box should be in double skin, (For AHU 4)	1	No.				
9	Supply & Installation of Booster Fan 4 with F9, H14 filters, 1100 cfm 1.5 inwg esp, box should be in double skin (For AHU 8)	1	No.				
10	Supply & Installation of Booster Fan 5 with H14 Hepa filter, 1300 cfm, static pressure as per filter requirement, box should be in double skin (For AHU 9)	1	No.				
11	Supply & Installation of Booster Fan 6 with H14 Hepa filter, 2400 cfm, static pressure as per filter requirement, box should be in double skin (For AHU 11)	1	No.				
12	Supply & Installation of Booster Fan 7 with 1.5 ton dx coil, F9, Filters, 2900 cfm, 2.5 inwg esp, box should be in double skin (For AHU 17)	1	No.				
13	Supply, Fabrication, Jointing and Installation of sheet metal duct work in PIR Duct Sheet as per standard for supply air ducting, plenums, fresh and exhaust air duct etc. making connection, MS support / hangers turning vanes, elbow tees etc. with volume control dampers and duct test holes at adequate location for proper balancing of the air side system and other necessary fittings / accessories complete in all respect as described in specification, schedule and drawings and as approved by the Engineer. Make: Kingspan or Equivalent						
	a) 20mm PIR Duct Work	25000	Sqft				
14	Cladding of exposed ducting as per specifications, complete in all respects.	10000	Sqft				
15	Supply and Installation of Flexible Ducts Connector for connection from Duct to AHU's, complete with all respect.	100	Rft				
16	Supply and Installation of Air Terminal HEPA Filters H14 as per below size						
	a) Hepa Filter Size:- 12 x 12 x 6 Inch	7	Nos.				
	b) Hepa Filter Size 15 x 15 x 6 Inch	10	Nos.				
	b) Hepa Filter Size:- 18 x 18 x 6 Inch	21	Nos.				
	c) Hepa Filter Size:- 24 x 24 x 6 Inch	40	Nos.				
17	Supply and Installation of Air Terminal HEPA Filters Housing in MS with powder coating as per below size						
	a) Size 12 x 12 x 6 Inch	7	Nos.				
	b) Size 15 x 15 x 6 Inch	10	Nos.				
	c) Size 18 x 18 x 6 Inch	21	Nos.				
	d) Size 24 x 24 x 6 Inch	40	Nos.				
18	Supply and Installation of Perforated Grills for Air Terminal HEPA Filters Housing in MS with Powder coating as per below size						
	a) HEPA Size 16 x 16 - 7#	1792	Sqinch				
	b) HEPA Size 19 x 19 - 10#	3610	Sqinch				

	b) HEPA Size 22 x 22 - 21#	10164	Sqinch				
	c) HEPA Size 28 x 28 - 40#	31360	Sqinch				
19	Supply, Installation and fixing of following type air devices extruded aluminium and powder coated color (approved by the Architect) including connections with air ducts and support arrangements as described in specifications, drawings complete in all respect and as approved by the Engineer.						
	a) Supply/Return Air Square Diffuser and Grills, (where applicable) (Similar to T&B Model AME 4-Way) with VCD	17,584	SqInch				
20	Supply and Installation of heavy gauge G.I. sheet metal gear operated, aerofoil blade manual volume control damper with adequate numbers duct test holes, complete in all respect and as required by the independent testing and balancing agency and to the satisfaction of the Engineer.	5200	SqInch				
21	Supply, Charging of refrigerant gas for all the newly installed package units.	4	units				
22	Supply and Installation of Plastic tags for all equipments / Valves identification and installed with chains. Identifications colour coding, stenciling and metallic stickers / name plate with required data on all piping, ducting, equipment and materials etc. as required by the Engineer, complete in all respect	1	Job				
23	Painting of all equipment, hangers, foundation supports, pipes, ducts, colour bends etc. complete in all respect to the satisfaction of the Engineer.	1	Job				
24	Cleaning the Chilled Water Piping with recommended chemical & adjusting and balancing of entire systems(AIR Balancing and Water Balancing) Complete in all respect and to the safety operation and to the satisfaction of the Engineer.	1	Job				
25	Providing of the AutoCAD (latest version) as-built drawings and 03 number of sets and soft copies on CD's as specified, complete in all respect and to the satisfaction of the Engineer.	1	Job				
26	Cost of six months system operation as required by the end user.	6	months				
27	Bidder to add items (if required) after visiting sites	1	Job				
		Material Cost				**Labor Cost**	
		GST 18%				**SRB 15%**	
		Total Cost					

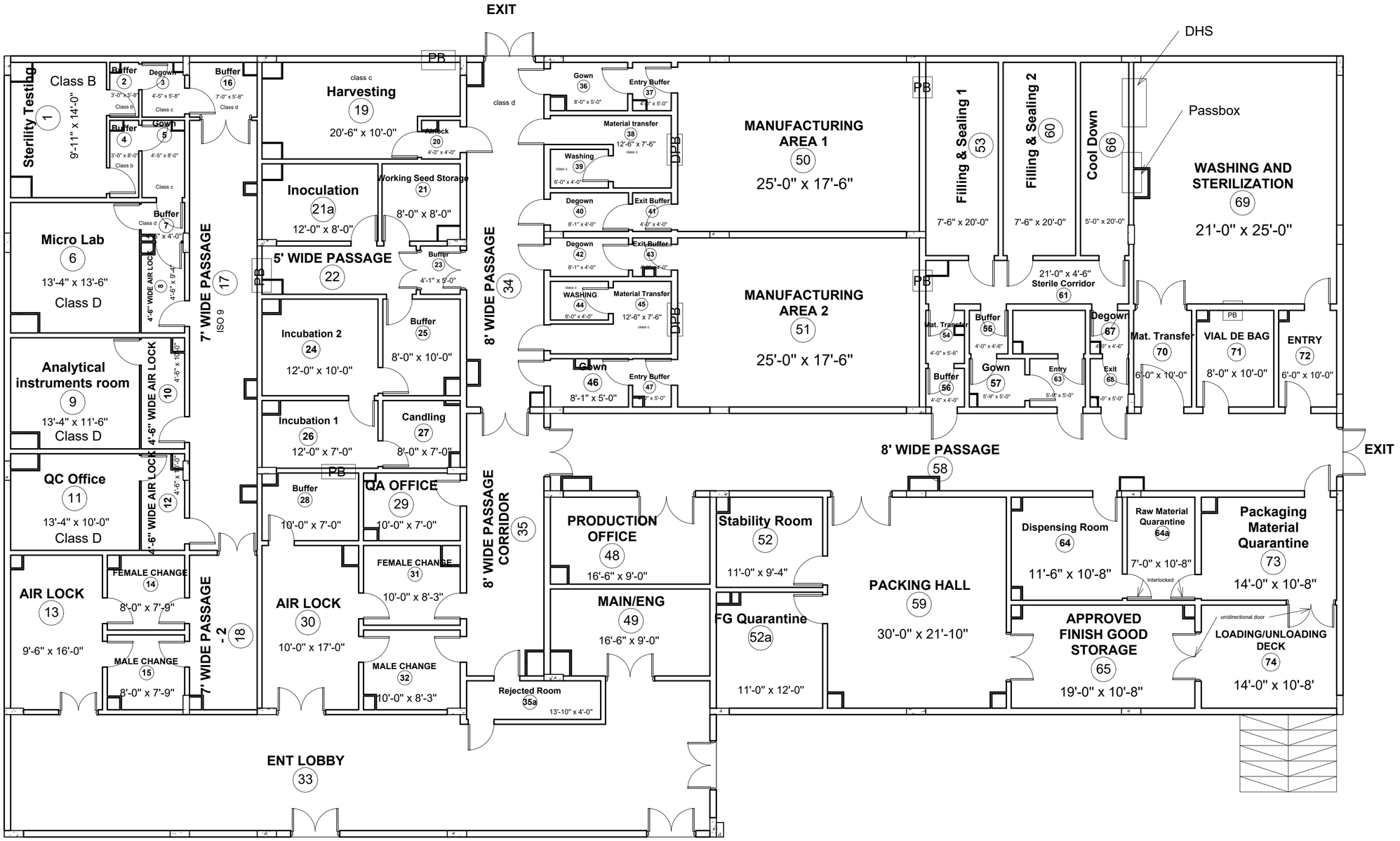
Subject:- Supply & Installation of BMS System for SIAH Killed Vaccine Unit							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ITEM NO.	DESCRIPTION	QTY.	UNIT	MATERIAL		INSTALL. / LABOUR	
				UNIT RATE	AMOUNT	UNIT RATE	AMOUNT
				(Rs.)	(Rs.)	(Rs.)	(Rs.)
					(3) x (5)		(3) x (7)
1	**New AHU system interfacing with old HVAC System BMS**						
	Interfacing of new AHUs with installed BACnet workstation including development of graphics, laying and extension of Bacnet cable with existing system, including system commissioning complete in all respect. Cost of Bacnet Controller already included in AHU Units cost in HVAC Section.	1	Job				-
2	Bidder to add items (if required) after visiting sites	1	Job				
	Total Carried to BMS System Works Summary :			**Total Material**	-	**Total Labo**	-
				GST 18%	-	**SRB 15%**	-
				Total Amount	-		

Subject:- Supply & Installation of Electrical for HVAC System for SIAH Killed Vaccine Unit							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ITEM NO.	DESCRIPTION	QTY.	UNIT	MATERIAL		INSTALL. / LABOUR	
				UNIT RATE	AMOUNT	UNIT RATE	AMOUNT
				(Rs.)	(Rs.)	(Rs.)	(Rs.)
					(3) x (5)		(3) x (7)
1	4core, 2.5 mm² Cu/PVC/PVC, from new condensors to new Ahus, for AHU motor	80	RM				
2	3core, 4.0 mm² Cu/PVC/PVC, from new condensors to new Ahus, for reheat coils	160	RM				
3	4core, 25 mm² Cu/PVC/PVC with 1core, 10 mm² as ECC from HVAC-Panel to AHU-12	38	RM				
4	4core, 25 mm² Cu/PVC/PVC with 1core, 10 mm² as ECC from HVAC-Panel to AHU-13	38	RM				
5	4core, 25 mm² Cu/PVC/PVC with 1core, 10 mm² as ECC from HVAC-Panel to AHU-14	38	RM				
6	4core, 10 mm² Cu/PVC/PVC with 1core, 6mm² as ECC from Condensor-16 to AHU-15	38	RM				
7	4core, 4.0 mm² Cu/PVC/PVC, from new HVAC Panel to all booster fans, including wire terminations complete in all respect.	150	RM				
8	G.I Cable tray Ladder type (6" x 4")	38	RM				
9	PVC Conduit Supply and Installtion (1" Dia)	1	Job				
10	HVAC PANEL for new AHU's including all accessories	1	Job				
11	Bidder to add items (if required) after visiting site	1	Job				
				Material Cost	-	**Labor Cost**	-
				GST 18%	-	**SRB 15%**	-
				Total Cost	-		

Subject:- Supply & Installation of Fire, CCTV, Data, Communication systems Killed vaccine Unit							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ITEM NO.	DESCRIPTION	QTY.	UNIT	MATERIAL		INSTALL. / LABOUR	
				UNIT RATE	AMOUNT	UNIT RATE	AMOUNT
				(Rs.)	(Rs.)	(Rs.)	(Rs.)
					(3) x (5)		(3) x (7)
1	Supply & Installation of Data/Telephone outlet in required rooms	30	Nos.				
2	Supply & Installation of CaT6 cable for wiring of data/telephone outlets	400	Rm.				
3	Supply & Installation of Telephone for communication between rooms	30	Nos.				
4	Supply & Installation of Data Rack with Switch	1	Nos.				
5	Supply & Installation of telephone PABX System	1	Nos.				
6	Supply & Installation of Smoke detectors	80	Nos.				
7	Supply & Installation of Fire alarm system	1	No.				
8	Supply & Installation of fire resistant cable for fire alarm system	300	Rm.				
9	Supply & Installation of Data Rack with Switch for CCTV System	1	Nos.				
10	Supply and Installation of CCTV. Brand: Imou or equivalent	65	Nos.				
11	Supply of CAT 6 Wire for CCTV	400	RM				
12	Supply and Installation of NVR with 2 TB HDD	1	No.				
13	Supply and Installation of 55" 4K LED TV for CCTV Cameras	1	No.				
14	Bidder to add items (if required) after visiting site	1	Job				
		Material Cost				Labor Cost	
		GST 18%				SRB 15%	
		Total Cost					

Subject:- Revalidation, Repair, Maintenance and Recommissioning of existing 85 ton chilled water system					
(1)	(2)	(3)	(4)	(7)	(8)
ITEM NO.	DESCRIPTION	QTY.	UNIT	INSTALL. / LABOUR	
				UNIT RATE (Rs.)	AMOUNT (Rs.)
					(3) x (7)
1	Repair, Revalidation and Recommissioning of OLD HVAC System: The scope of work includes but not limited to the provision, repair, replacement and fixing of air filters in AHUs; bearing replacement and fan belt changes for all AHUs; recommissioning of the chiller with component replacements such as oil and filter drier; descaling of water pipes with chemical treatment; reapplication and repair of damaged chilled water pipe insulation; repair and recommissioning of the complete BMS system including controllers and sensors; repair and recommissioning of the electrical system including VFDs and DOL starters; revalidation and qualification of the existing system; and a one-month test run with all required observations and data logging.	1	Job		
				Labor Cost	
				SRB 15%	
				Total Cost	

Ground floor Layout Plan



Total Covered Area: 10375 Sqft.

CLIENT :

MEP Consultants

Universal Engineering Services
Engineers & Planners

308 Al Amin Tower Gulshan-e-Iqbal Block-10
Karachi
Email: uni_engg_ser@yahoo.com

Project :

Sindh Institute of Animal Health (SIAH)
Killed Vaccine Manufacturing Unit

Title :

Civil Layout

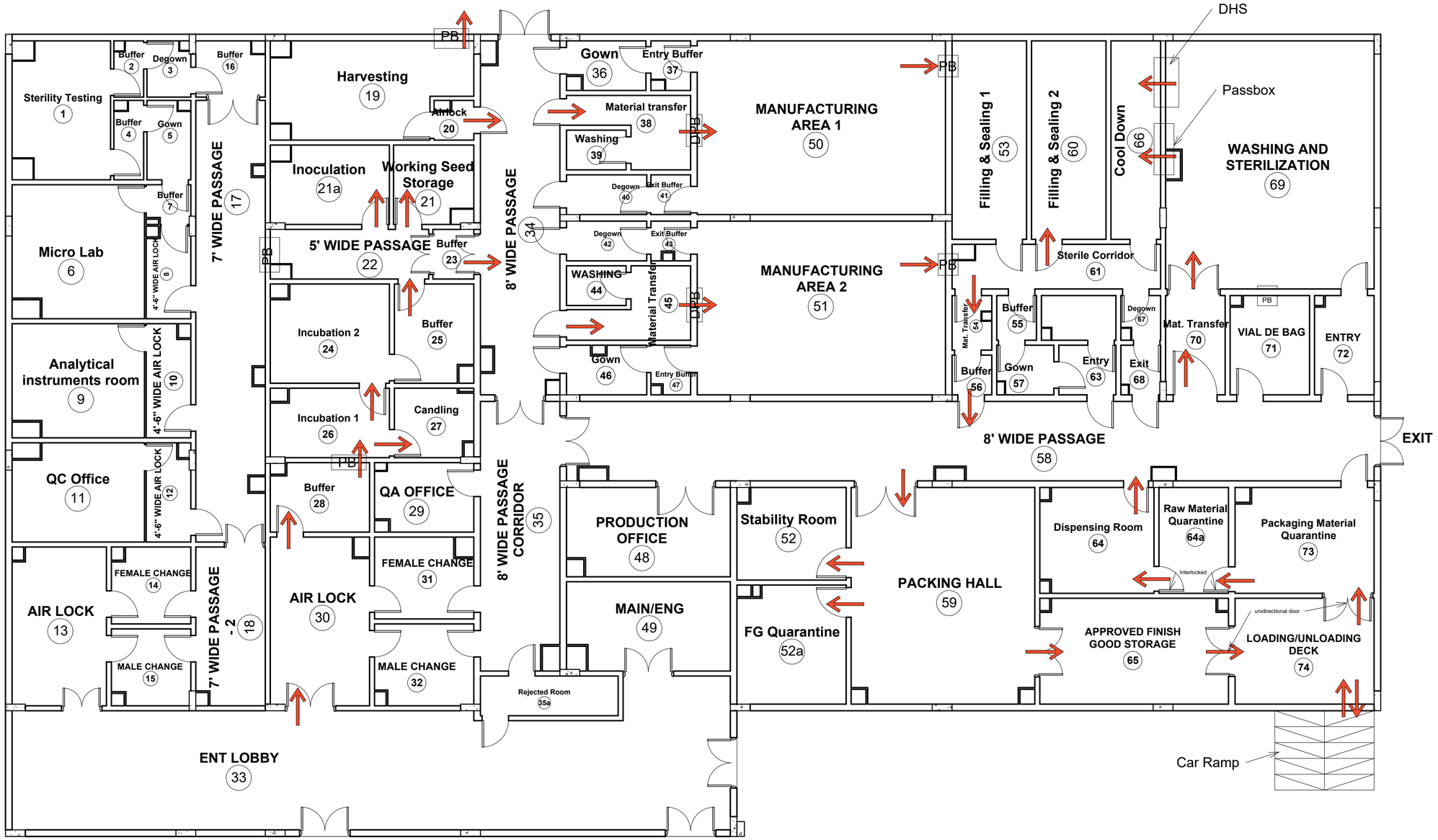
Approved by Technical Consultant:

Designed & Checked by Design Consultant:

Scale : NTS

Drawing No:	Date:
A-101	20-05-2024

Material Flow



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Killed Vaccine Manufacturing Unit

Title :

Material Flow

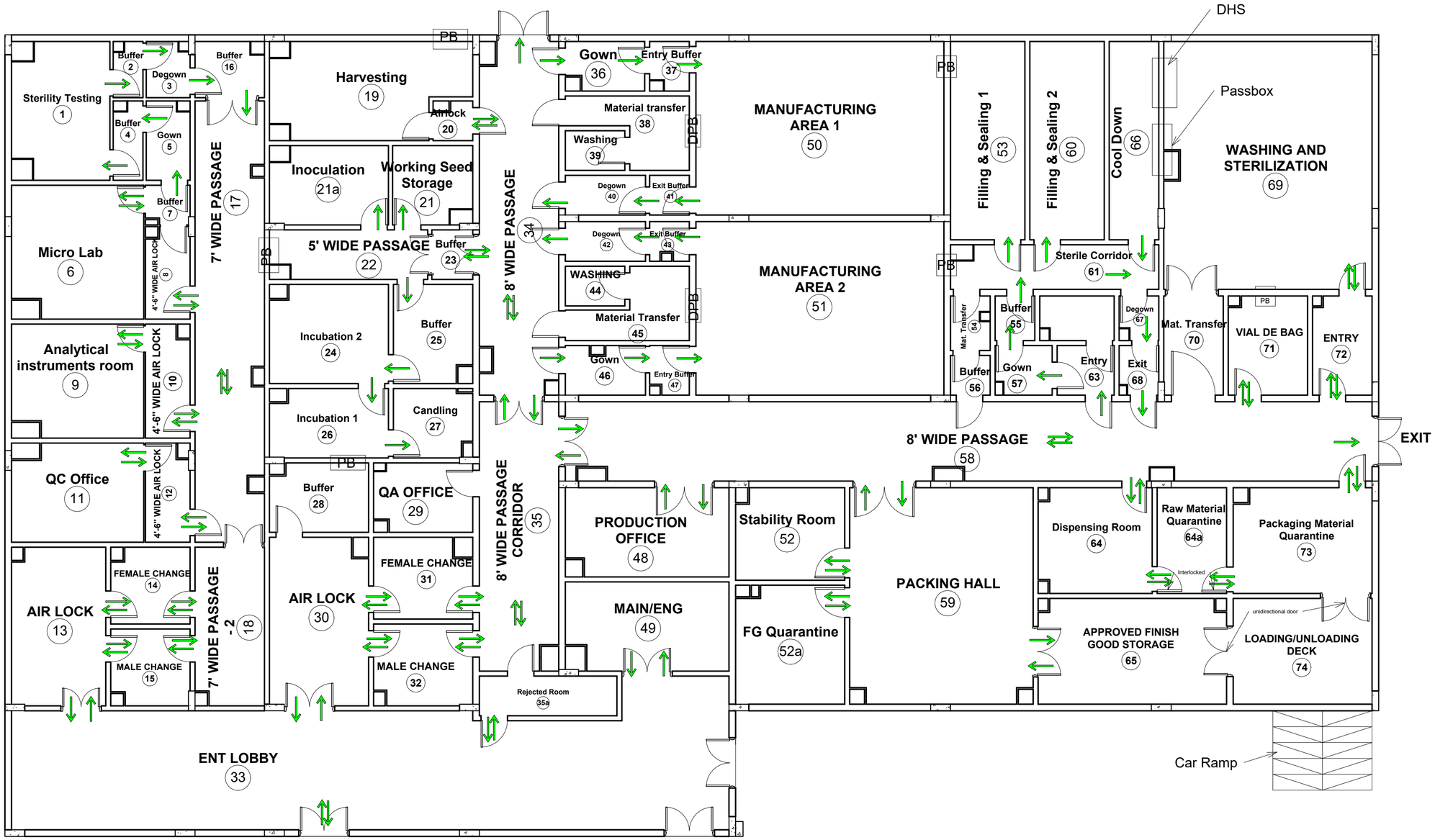
Approved by Technical Consultant:

Designed & Checked by Design Consultant:

Scale : NTS

Drawing No:	Date:
A-102	10-04-2024

Personnel Flow



CLIENT :

MEP Consultants

Universal Engineering Services
Engineers & Planners

308 Al Amin Tower Gulshan-e-Iqbal Block-10
Karachi
Email: uni_engg_ser@yahoo.com

Project :

Sindh Institute of Animal Health (SIAH)
Killed Vaccine Manufacturing Unit

Title :

Personnel Flow

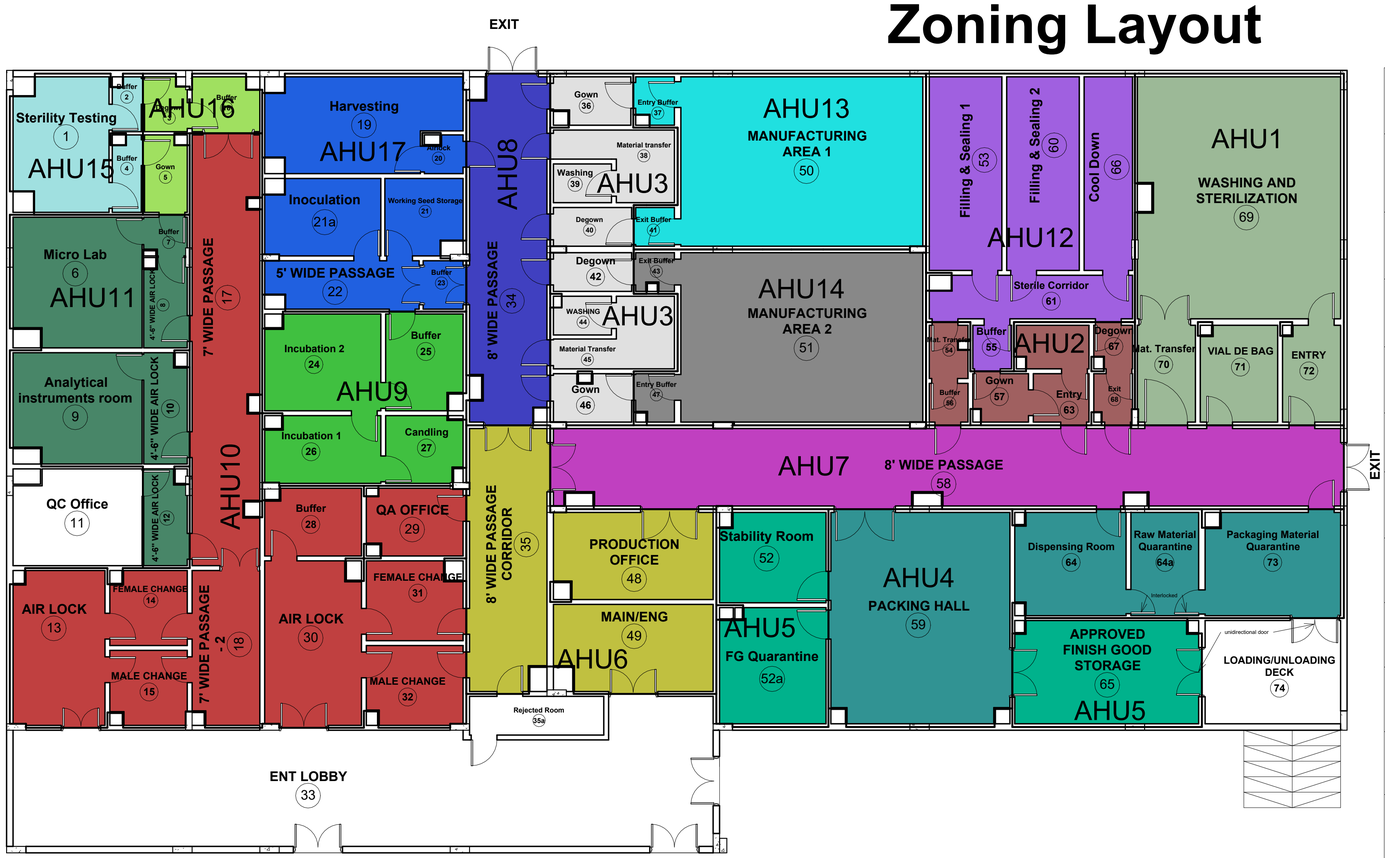
Approved by Technical Consultant:

Designed & Checked by Design Consultant:

Scale : NTS

Drawing No:	Date:
A-103	10-04-2024

Zoning Layout



AHU. No	Area Served	Grade
AHU1	Washing and Sterilization (69) Mat. Transfer (70) Vial De Bag (71), Entry (72)	Grade D
AHU2	Mat. Transfer(54),Gown(57), WIP(62), Degown (67)	Grade C
	Buffer (56), Exit (68), Entry (63)	Grade D
AHU3	Material Transfer (38), Washing (39), Gown (36), Degown (40) Degown (42), Material Transfer (38), Gown(46), Washing (44)	Grade C
AHU4	Packing Hall (59), Dispensing Room (64), Raw Material Quarantine (64a), Packaging Material Quarantine (73)	Grade D
AHU5	Stability Room (52), FG Quarantine (52a), Approved Finshed Good Storage (65)	CBNC/ISO 9
AHU6	8' Wide Passage Corridor (35), Production Office (48), Main/Eng(49)	CBNC/ISO 9
AHU7	8' Wide Passage (58)	CBNC/ISO 9
AHU8	8' Wide Passage (34)	Grade D
AHU9	Incubation 2 (24), Buffer (25), Incubation 1 (26), Candling (27)	Grade D
AHU10	Airlock (13), Female Change (14), Change room (15), 7' Wide passage (17), 7' Wide passage (18), Buffer (28), QA Office (29), Airlock (30), Female Change (31), Male Change (32)	CBNC/ISO 9
AHU11	MicroBiology (6), Buffer (7), Analytical instruments room(9), QC Office(11)	Grade D
	4.5' Wide Airlock(8), 4.5' Wide Airlock(10), 4.5' Wide Airlock(12)	
AHU12	Filling & Sealing 1 (53), Filling & Sealing 2 (60) Sterile Corridor (61), Cool Down (66)	Grade B
AHU13	Manufacturing Area 1 (50), Entry Buffer (37), Exit Room (41)	Grade B
AHU14	Manufacturing Area 2 (51), Entry Buffer (47), Exit Room (43)	Grade B
AHU15	Sterility Testing (1), Buffer (2), Buffer (4)	Grade B
AHU16	Degown (3), Gown (5)	Grade C
	Buffer(16)	Grade D
AHU17	Working Seed Storage (21), Inoculation (21a), Harvesting room (19), Airlock (20), 5' Wide Passage (22), Buffer (23),	Grade C

NEW AHU #	OLD AHU #
AHU 1	AHU 1
AHU 2	AHU 12 with booster fan
AHU 3	AHU 3
AHU 4	AHU 2
AHU 5	AHU 5
AHU 6	AHU 9
AHU 7	AHU 8
AHU 8	AHU 7 with booster fan

NEW AHU #	OLD AHU #
AHU 9	AHU 6 with booster fan
AHU 10	AHU 11
AHU 11	AHU 13 wtih booster fan
AHU 12	New AHU
AHU 13	New AHU
AHU 14	New AHU
AHU 15	New AHU
AHU 16	AHU 4
AHU 17	AHU 10 with booster fan

CLIENT :

S.I.A.H
SINDH INSTITUTE OF ANIMAL HEALTH, KARACHI

UES

Universal Engineering Services
Engineers & Planners
308 Al Amin Tower Gulshan-e-Iqbal
Block-10 Karachi
Email: uni_engg_ser@yahoo.com

Project :

Sindh Institute of Animal Health (SIAH) Killed Vaccine Manufacturing Unit

Title :

Zoning Layout

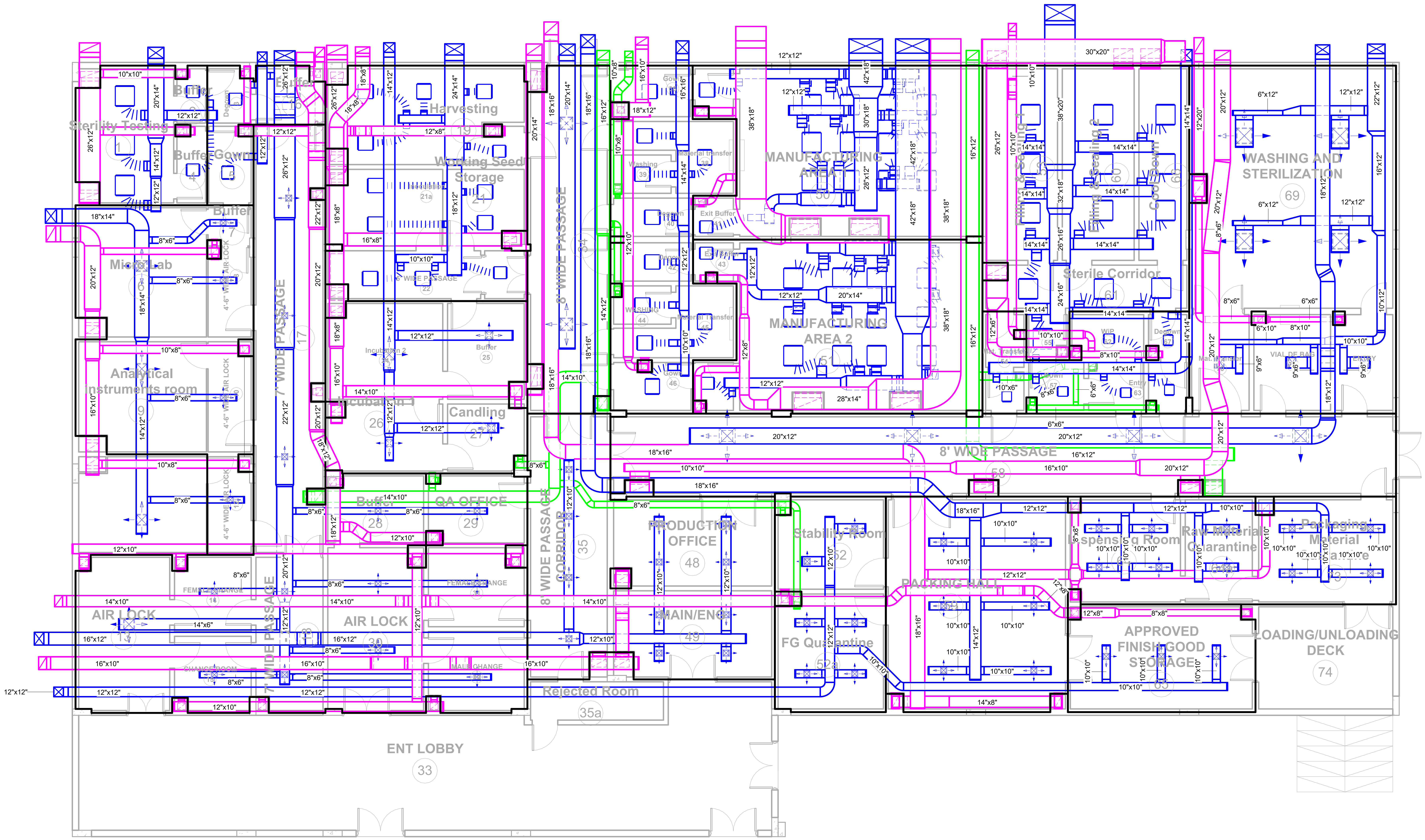
Approved by Technical Consultant:

Designed & Checked by Design Consultant:

Drawing No :
A-104

Scale:
NTS

DATE:
10-04-2024



CLIENT :

MEP Consultants

Universal Engineering Services
Engineers & Planners

308 Al Amin Tower Gulshan-e-Iqbal Block-10
Karachi
Email: uni_engg_ser@yahoo.com

Project :

Sindh Institute of Animal Health (SIAH)
Killed Vaccine Manufacturing Unit

Title :

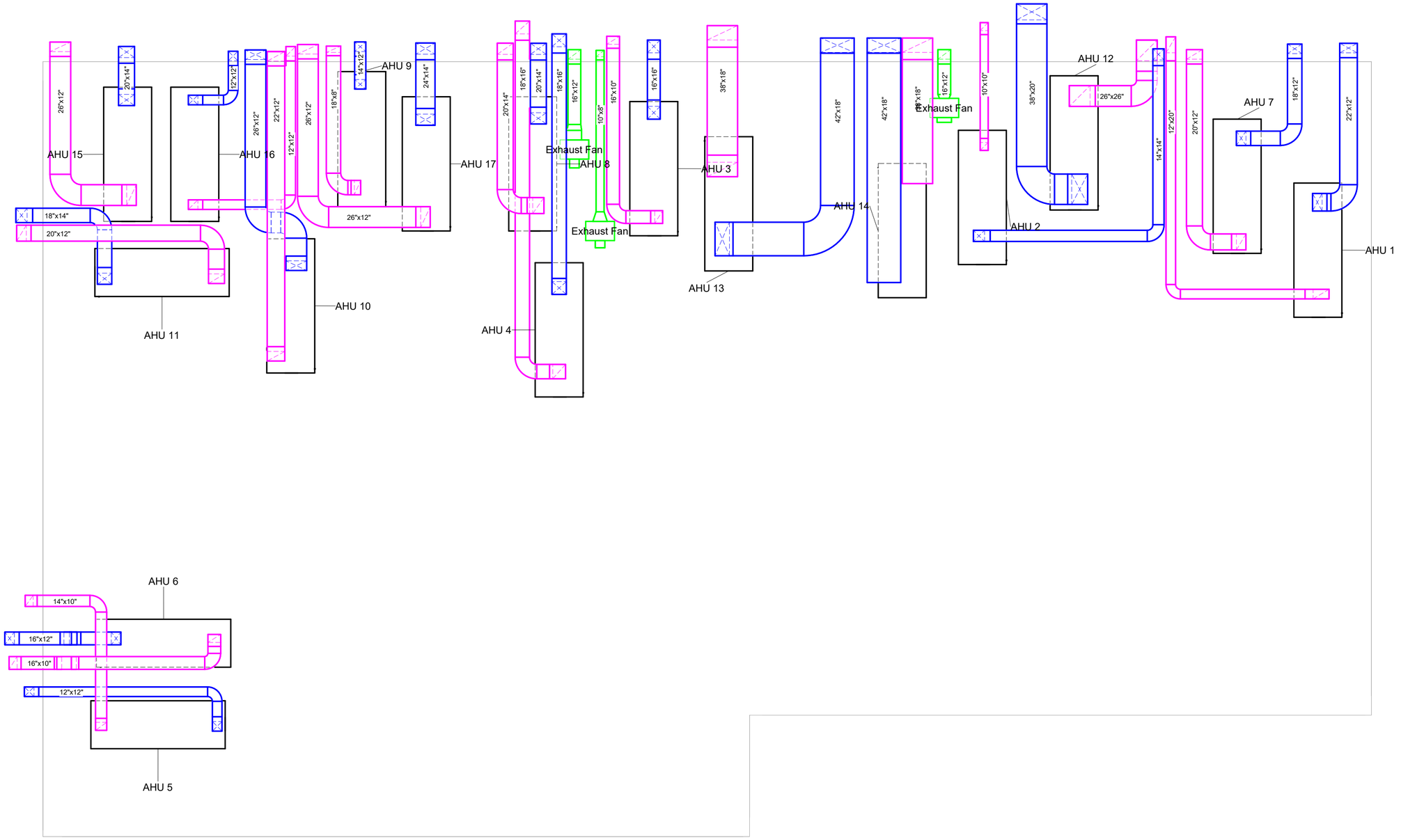
Ducting layout

Approved by Technical Consultant:

Designed & Checked by Design Consultant:

Scale : NTS

Drawing No:	Date:
A-105	10-04-2024



CLIENT :

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Karachi
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Project :

Sindh Institute of Animal Health (SIAH)
Killed Vaccine Manufacturing Unit

Title :

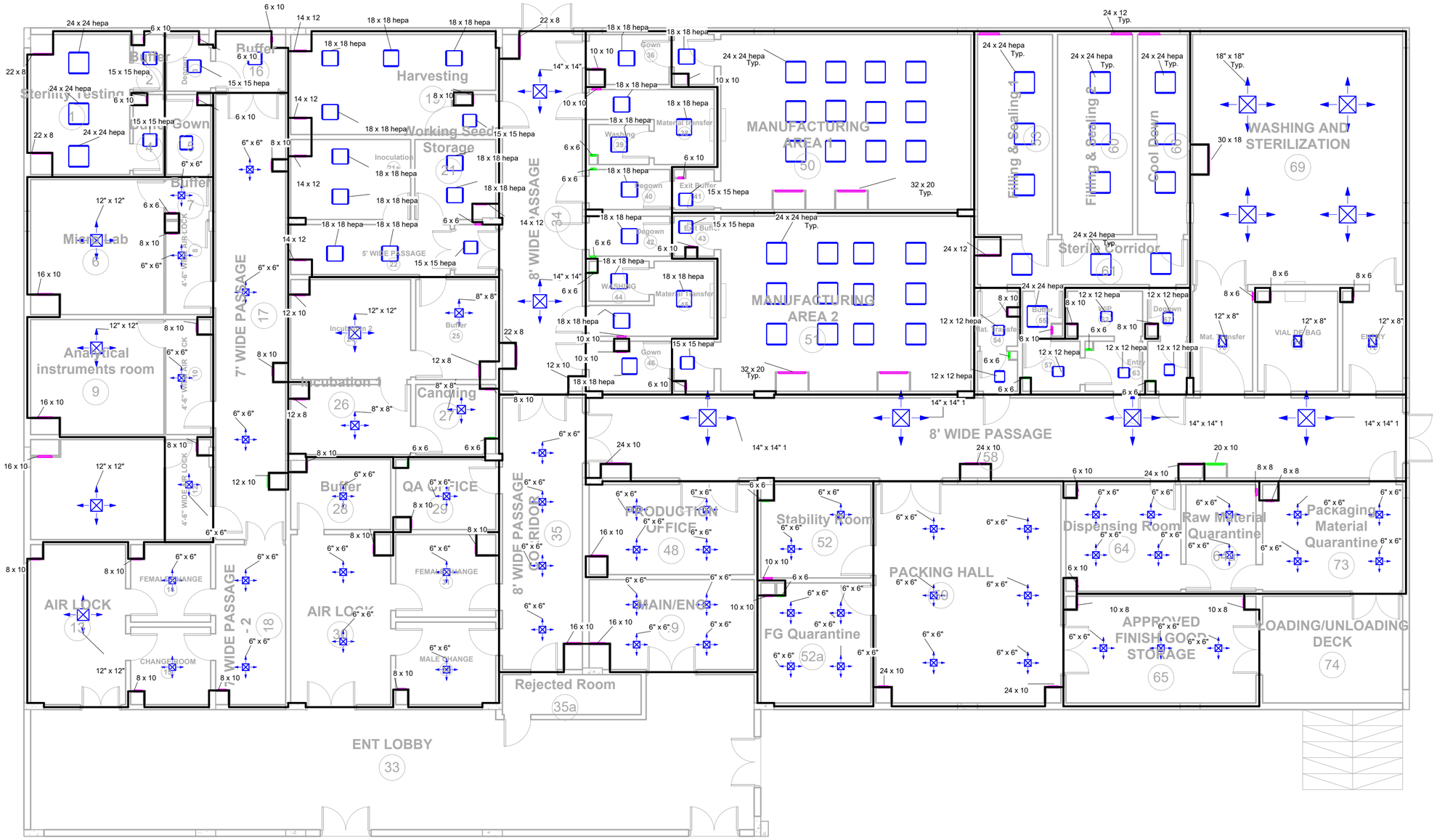
Ducting layout Roof

Approved by Technical Consultant:

Designed & Checked by Design Consultant:

Scale : NTS

Drawing No:	Date:
A-106	10-04-2024



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Email: uni_engg_ser@yahoo.com

Project :

Sindh Institute of Animal Health (SIAH)
Killed Vaccine Manufacturing Unit

Title :

Air terminal

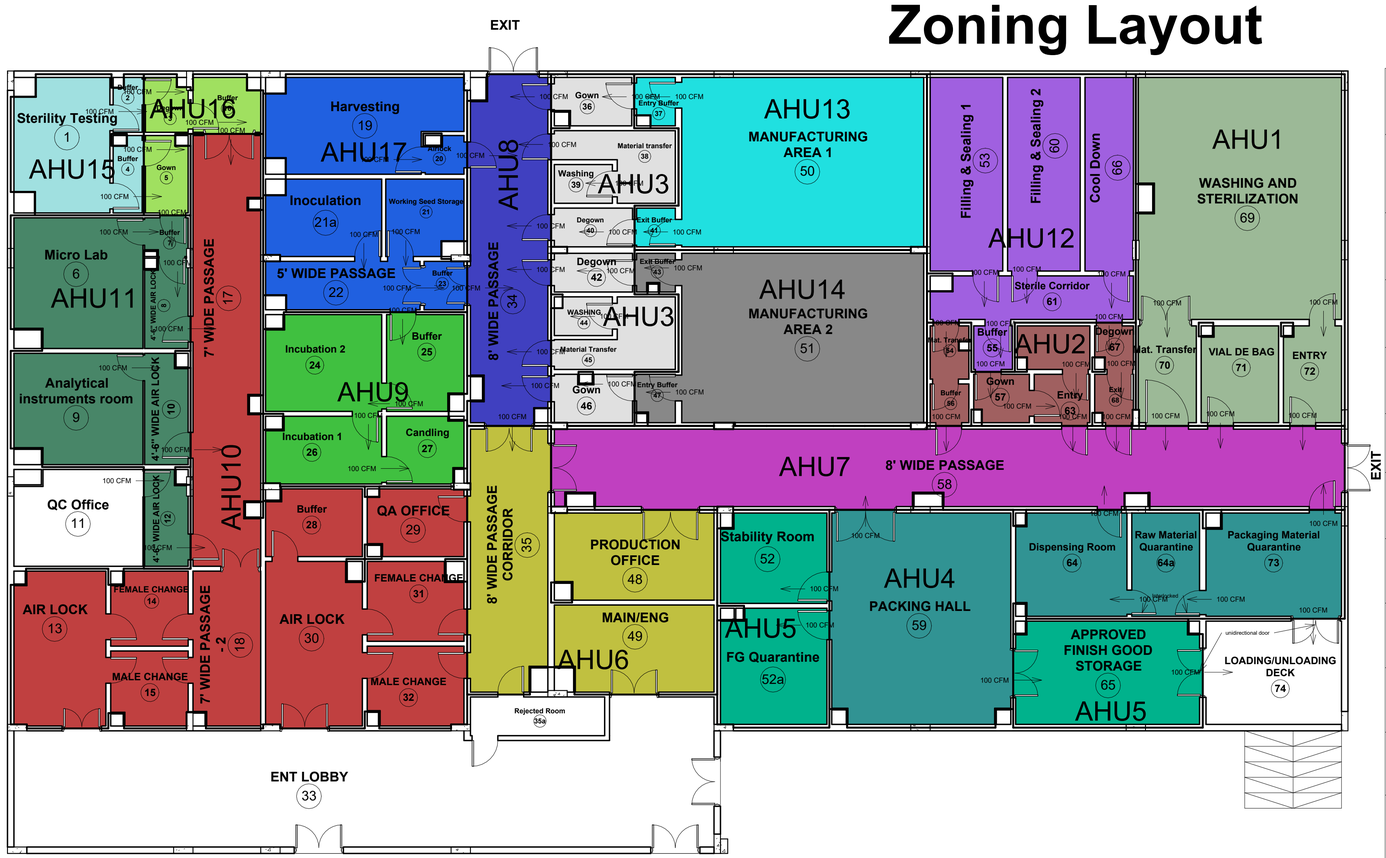
Approved by Technical Consultant:

Designed & Checked by Design Consultant:

Scale : NTS

Drawing No:	Date:
A-107	10-04-2024

Zoning Layout



AHU. No	Area Served	Grade
AHU1	Washing and Sterilization (69) Mat. Transfer (70) Vial De Bag (71), Entry (72)	Grade D
AHU2	Mat. Transfer(54),Gown(57), WIP(62), Degown (67)	Grade C
	Buffer (56), Exit (68), Entry (63)	Grade D
AHU3	Material Transfer (38), Washing (39), Gown (36), Degown (40) Degown (42), Material Transfer (38), Gown(46), Washing (44)	Grade C
AHU4	Packing Hall (59), Dispensing Room (64), Raw Material Quarantine (64a), Packaging Material Quarantine (73)	Grade D
AHU5	Stability Room (52), FG Quarantine (52a), Approved Finshed Good Storage (65)	CBNC/ISO 9
AHU6	8' Wide Passage Corridor (35), Production Office (48), Main/Eng(49)	CBNC/ISO 9
AHU7	8' Wide Passage (58)	CBNC/ISO 9
AHU8	8' Wide Passage (34)	Grade D
AHU9	Incubation 2 (24), Buffer (25), Incubation 1 (26), Candling (27)	Grade D
AHU10	Airlock (13), Female Change (14), Change room (15), 7' Wide passage (17), 7' Wide passage (18), Buffer (28), QA Office (29), Airlock (30), Female Change (31), Male Change (32)	CBNC/ISO 9
AHU11	MicroBiology (6), Buffer (7), Analytical instruments room(9), QC Office(11)	Grade D
	4.5' Wide Airlock(8), 4.5' Wide Airlock(10), 4.5' Wide Airlock(12)	
AHU12	Filling & Sealing 1 (53), Filling & Sealing 2 (60) Sterile Corridor (61), Cool Down (66)	Grade B
AHU13	Manufacturing Area 1 (50), Entry Buffer (37), Exit Room (41)	Grade B
AHU14	Manufacturing Area 2 (51), Entry Buffer (47), Exit Room (43)	Grade B
AHU15	Sterility Testing (1), Buffer (2), Buffer (4)	Grade B
AHU16	Degown (3), Gown (5)	Grade C
	Buffer(16)	Grade D
AHU17	Working Seed Storage (21), Inoculation (21a), Harvesting room (19), Airlock (20), 5' Wide Passage (22), Buffer (23),	Grade C

NEW AHU #	OLD AHU #
AHU 1	AHU 1
AHU 2	AHU 12 with booster fan
AHU 3	AHU 3
AHU 4	AHU 2
AHU 5	AHU 5
AHU 6	AHU 9
AHU 7	AHU 8
AHU 8	AHU 7 with booster fan

NEW AHU #	OLD AHU #
AHU 9	AHU 6 with booster fan
AHU 10	AHU 11
AHU 11	AHU 13 wtih booster fan
AHU 12	New AHU
AHU 13	New AHU
AHU 14	New AHU
AHU 15	New AHU
AHU 16	AHU 4
AHU 17	AHU 10 with booster fan

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Project :

Sindh Institute of Animal Health (SIAH) Killed Vaccine Manufacturing Unit

Title :

Air Flow Direction with zoning

Approved by Technical Consultant:

Designed & Checked by Design Consultant:

Drawing No : A-108

Scale: NTS

DATE: 10-04-2024

Self Contained Package Unit Specifications

Pacakge Unit	AHU-12 (Filling and Sealing)	AHU-13 Manufacturing 1	AHU-14 Manufacturing 1	AHU-15 Sterility Area
Supply Airflow (CFM)	6700 CFM	6200 CFM	6200 CFM	2500 CFM
Fresh Air CFM	450 CFM	300 CFM	300 CFM	300 CFM
Class	Hygienic AHU	Hygienic AHU	Hygienic AHU	Hygienic AHU
Outdoor Design Condition (°F)	105 DB/83 WB	105 DB/83 WB	105 DB/83 WB	105 DB/83 WB
Indoor Design Condition (°C)	22 °C / 50% RH	22 °C / 50% RH	22 °C / 50% RH	22 °C / 50% RH
Coil Entering DB/WB (°F)	72.7 / 61.7	72.3 / 61.2	72.3 / 61.2	73.5 / 63.2
Coil Leaving DB/WB (°F)	53.6 / 52.6	53.6 / 52.6	53.6 / 52.6	53.6 / 52.6
Coil Loads (tons)	14.6	12.6	12.6	6.5
3-Stage Reheat Coil Size	72.0 MBH	67.0 MBH	67.0 MBH	27.0 MBH
ESP (inwg)	3.5	3.5	3.5	3.5
Filtration	G4, F7, F9, H13	G4, F7, F9, H13	G4, F7, F9, H13	G4, F7, F9, H13
VFD compatibility for AHU	Yes	Yes	Yes	Yes
Type of Controls System	PLC/DDC Controller (Bacnet Compatible)	PLC/DDC Controller (Bacnet Compatible)	PLC/DDC Controller (Bacnet Compatible)	PLC/DDC Controller (Bacnet Compatible)
Remarks	top suction front discharge	top suction front discharge	top suction front discharge	top suction front discharge

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Project :

Sindh Institute of Animal Health (SIAH) Killed Vaccine Manufacturing Unit

Title :

Package Unit Specs

Approved by Technical Consultant:

Designed & Checked by Design Consultant:

Scale : NTS

Drawing No:	Date:
A-109	10-04-2024

SCHEDULE OF REQUIREMENTS / BOQ

DATA SHEET / ASSIGNMENT INFORMATION

HVAC BOQ for SIAH Live Vaccine Facility Block A & B

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ITEM NO.	DESCRIPTION	QTY.	UNIT	MATERIAL		INSTALL. / LABOUR	
				UNIT RATE	AMOUNT	UNIT RATE	AMOUNT
				(Rs.)	(Rs.)	(Rs.)	(Rs.)
					(3) x (5)		(3) x (7)
1	Suppply & Installation of Self Contained Package Units with 50mm panel thickness as per attached specifications. The unit will be provided with Scroll compressors. The unit will have acrylic coating on coil fins. * See Equipment Schedule for further details						
a	AHU-01	1	No.				
b	AHU-02	1	No.				
c	AHU-03	1	No.				
d	AHU-04	1	No.				
e	AHU-05	1	No.				
f	AHU-06	1	No.				
g	AHU-07	1	No.				
h	AHU-08	1	No.				
i	AHU-09	1	No.				
j	AHU-10	1	No.				
k	AHU-11	1	No.				
2	Supply and Installation of Cabinet type Exhaust Fans with below specifications. Type :- Inline Duct Fan						
	a) Exhaust Fan 200 CFM, ESP 1.0 inwg	1	No.				

	b) Exhaust Fan 1800 CFM, ESP 1.5 inwg	1	No.				
3	Supply and construction of RCC Foundation on proposed roof for AHUs and Condensing units as per requirement. Hanging of Inline Duct Fans as required	1	Job				
4	Rigging and Shifting of HVAC Equipment to proposed rooftop location	1	Job				
5	Supply, Fabrication, Jointing and Installation of 20mm PIR Duct Sheet as per standard for supply air ducting, plenums, fresh and exhaust air duct etc. making connection, MS support / hangers turning vanes, elbow tees etc. with volume control dampers and duct test holes at adequate location for proper balancing of the air side system and other necessary fittings / accessories complete in all respect as described in specification, schedule and drawings and as approved by the Engineer. Make: Kingspan or Equivalent	20000	Sqft				
6	Cladding of exposed ducting as per specifications, complete in all respects.	7800	Sqft				
7	Supply and Installation of Flexible Ducts Connector for connection from Duct to AHU's, complete with all respect.	200	Rft				
8	Insulated Flex Duct 8"	60	Rft				
9	Insulated Flex Duct 12"	80	Rft				
10	Supply, Installation and fixing of following type air devices extruded aluminium and powder coated color (approved by the Architect) including connections with air ducts and support arrangements as described in specifications, drawings complete in all respect and as approved by the Engineer.						
	a) Supply/Return Air Square Diffuser and Grills, (where applicable) (Similar to T&B Model AME 4-Way) with VCD	13600	SqInch				
11	Supply and Installation of heavy gauge G.I. sheet metal gear operated, aerofoil blade manual volume control damper with adequate numbers duct test holes, complete in all respect and as required by the independent testing and balancing agency and to the satisfaction of the Engineer.	6000	SqInch				
12	Supply and Installation of Air Terminal HEPA Filters H14 as per below size						
	a) Hepa Filter Size:- 15 x 15 x 6 Inch	12	Nos.				
	b) Hepa Filter Size:- 18 x 18 x 6 Inch	7	Nos.				

	c) Hepa Filter Size:- 24 x 24 x 6 Inch	23	Nos.				
13	Supply and Installation of Air Terminal HEPA Filters Housing in MS with powder coating as per below size						
	a) Size 15 x 15 x 6 Inch	12	Nos.				
	b) Size 18 x 18 x 6 Inch	7	Nos.				
	c) Size 24 x 24 x 6 Inch	23	Nos.				
14	Supply and Installation of Perforated Grills for Air Terminal HEPA Filters Housing in MS with Powder coating as per below size						
	a) HEPA Size 19 x 19 - 12#	4332	Sqinch				
	b) HEPA Size 22 x 22 - 7#	3388	Sqinch				
	c) HEPA Size 28 x 28 - 23#	18032	Sqinch				
15	Supply & Installation of wall / Floor mounted HVAC Panel IP-54 for HVAC Equipment, with following safety devices including Lugs and termination & Tagging, complete in all respect. with Measuring Instrument / Meter with selector Higher Conductivity & 99.9% Tin Coated Bus bar * see equipment schedule for details	1	No.				
16	Supply & Installation of Electrical wiring with proper laying in Cable Tray / Electrical PVC conduit including MS supports, for HVAC Equipments from MCC Panel with following specs, Complete in all respect.						
	a) 2 runs of 4 core, 185mm², PVC/PVC Cu Cable with 1 core 25mm² as ECC for main feeder cable for HVAC Panel	45	M				
	b) 4 core, 16mm², PVC/PVC Cu Cable with 1 core 6mm² as ECC for AHU-01 from HVAC Panel	30	M				
	c) 4 core, 6mm², PVC/PVC Cu Cable with 1 core 4mm² as ECC for AHU-02 from HVAC Panel	15	M				
	d) 4 core, 50mm², PVC/PVC Cu Cable with 1 core 10mm² as ECC for AHU-03 from HVAC Panel	25	M				
	e) 4 core, 4mm², PVC/PVC Cu Cable with 1 core 4mm² as ECC for AHU-04 from HVAC Panel	30	M				
	f) 4 core, 2.5mm², PVC/PVC Cu Cable with 1 core 2.5mm² as ECC for AHU-05 from HVAC Panel	30	M				
	g) 4 core, 50mm², PVC/PVC Cu Cable with 1 core 10mm² as ECC for AHU-06 from HVAC Panel	15	M				
	h) 4 core, 10mm², PVC/PVC Cu Cable with 1 core 6mm² as ECC for AHU-07 from HVAC Panel	10	M				

	i) 4 core, 2.5mm², PVC/PVC Cu Cable with 1 core 2.5mm² as ECC for AHU-08 from HVAC Panel	20	M				
	j) 4 core, 10mm², PVC/PVC Cu Cable with 1 core 6mm² as ECC for AHU-09 from HVAC Panel	25	M				
	k) 4 core, 4mm², PVC/PVC Cu Cable with 1 core 4mm² as ECC for AHU-10 from HVAC Panel	15	M				
	l) 4 core, 4mm², PVC/PVC Cu Cable with 1 core 4mm² as ECC for AHU-11 from HVAC Panel	10	M				
	m) 4 core, 2.5mm², PVC/PVC Cu Cable with 1 core 2.5mm² as ECC for Ex. Fan (1656 CFM) from HVAC Panel	40	M				
	n) 2 core, 2.5mm², PVC/PVC Cu Cable with 1 core 2.5mm² as ECC for Ex. Fan (200 CFM) from HVAC Panel	50	M				
17	Supply, installation of MS Powdered coated perforated cable tray in 16gage with 18 guage cover for electrical wiring of AHU's						
	a) Cable Tray szie :- 12"x 6"	80	M				
18	Supply and Installation of Conduits for electrical wiring for HVAC Circuits as required	1	Lot				
19	Testing, Airbalancing and commissioning of installed AHUs	1	Job				
20	Supply and Installation of Plastic tags for all equipments / Valves identification and installed with chains. Identifications colour coding, stenciling and metallic stickers / name plate with required data on all piping, ducting, equipment and materials etc. as required by the Engineer, complete in all respect	1	Job				
21	Painting of all equipment, hangers, foundation supports, pipes, ducts, colour bends etc. complete in all respect to the satisfaction of the Engineer.	1	Job				
22	Providing of the AutoCAD (latest version) as-built drawings and 03 number of sets and soft copies on CD's as specified, complete in all respect and to the satisfaction of the Engineer.	1	Job				
23	Supply of operation and maintenance manuals with complete catalogues, manufacturer's maintenance and operation manuals in the form specified in the documents / specification and to the satisfaction of the Engineer. Complete in all respect and required.	1	Job				
24	Cost of two months test run each in the peak summer and winter season as reauired by the Consultant / Enaineer or end user.	1	Job				

25	Supply and Installation of PVC sleeves for pipes and G.I. sheet sleeves for duct work in all masonry and RCC structure as required for the system installation.	1	Job				
26	Supply & Installation of Desktop Computer with SCADA Software to connect all Package Unit's Logo PLC with centralized SCADA workstation including network switches, CAT6 Cable, Programming & Interfacing, complete in all respect.	1	Job				
		Material Cost				**Labor Cost**	
		GST 18%				**SRB 15%**	
		Total Cost					

List of Drawings	
A-01	Ducting Layout
A-02	Air Terminal Layout
A-03	AHU Layout
A-04	SLD - HVAC Power Panel
A-05	Equipment Schedule
A-06	Zoning Layout
A-07	Airflow Layout

CLIENT :

HVAC Consultants

Universal Engineering Services
Engineers & Planners

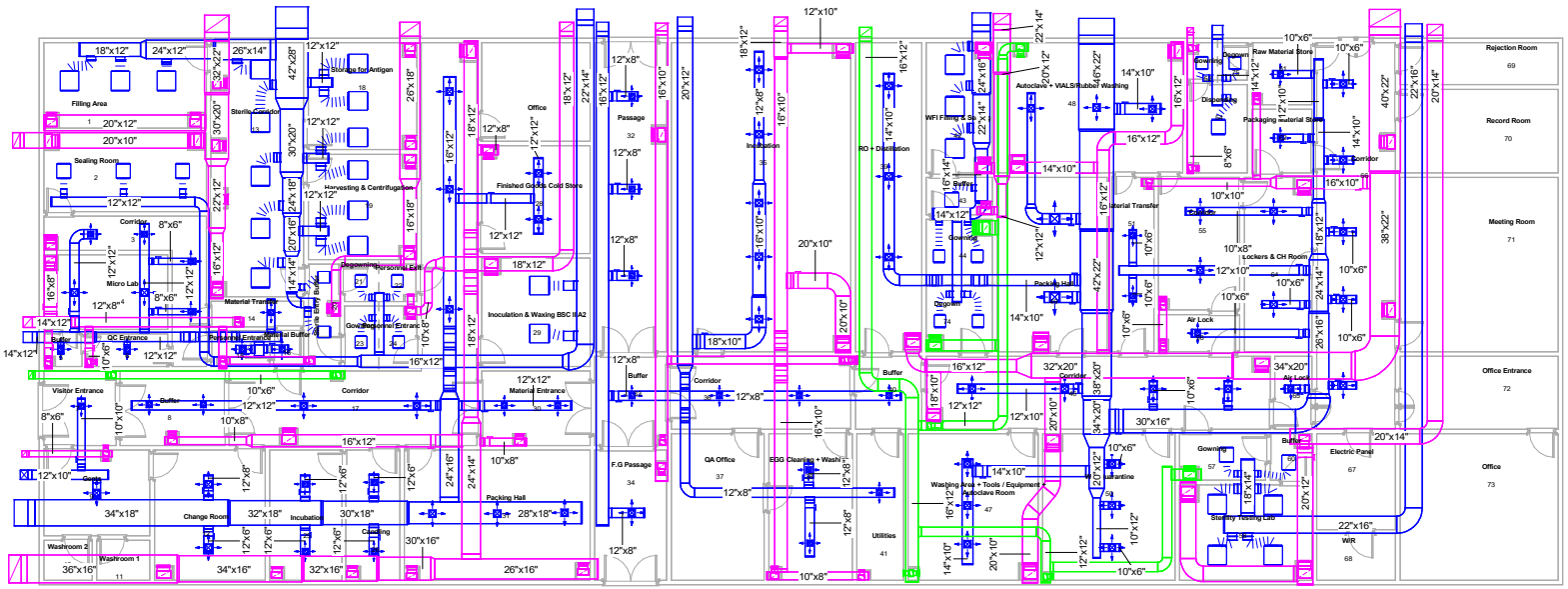
308 Al Amin Tower Gulshan-e-Iqbal Block-10
Karachi
Email: uni_engg_ser@yahoo.com

Job :
SIAH LIVE VACCINE

Title :
List of Drawings

Revision Schedule		
Revision Number	Revision Description	Revision Date
1	Tender Dwgs	03-09-2025

Approved: IA	Drawn By : HA
Checked: SA	
Scale :	
Drawing No:	Date: 03-09-2025
A-00	Rev: 1



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Job :

SIAH LIVE VACCINE

Title :

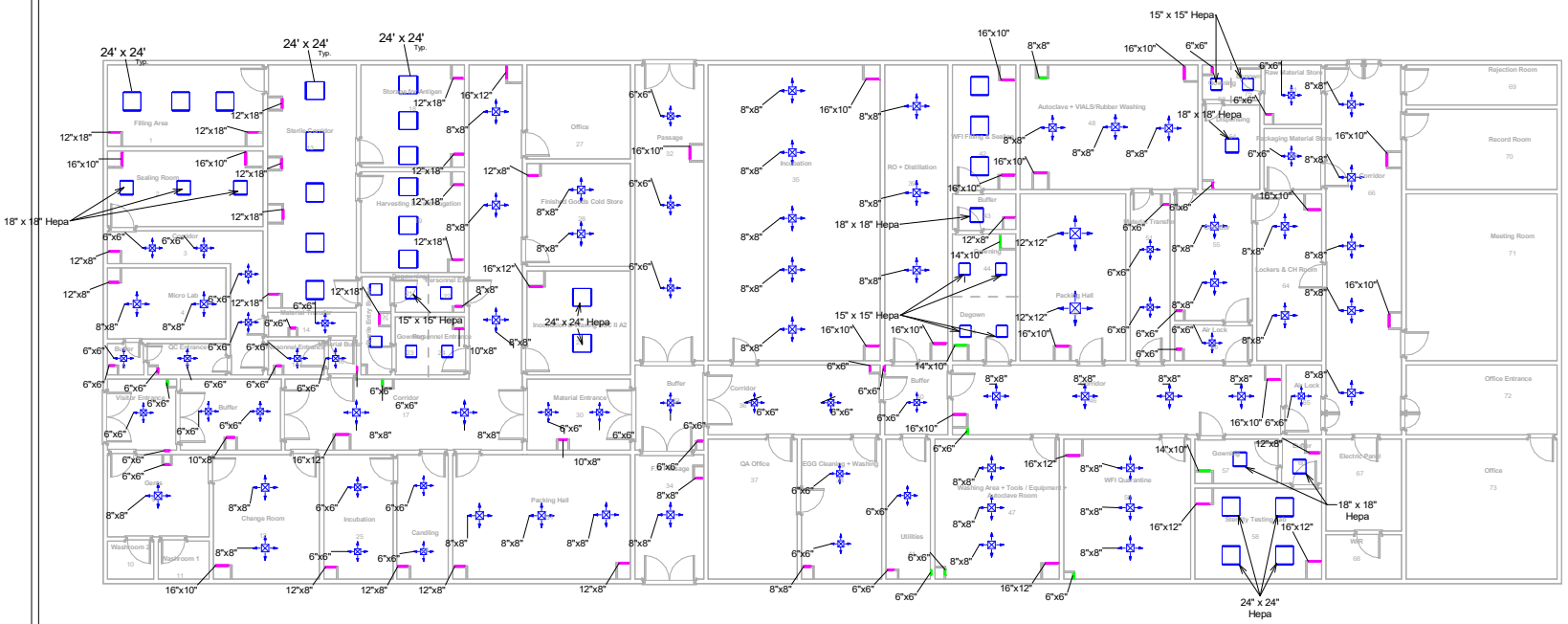
Ducting Layout

Revision Schedule		
Revision Number	Revision Description	Revision Date
1	Tender Dwgs	03-09-2025

Approved: IA	Cad By : HA
Checked: HA	
Scale : 1/8" = 1'-0"	

Remarks:

Drawing No:	Date: 03-09-2025
A-01	Rev: 1



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Karachi
Email: uni_engg_ser@yahoo.com

Job :

SIAH LIVE VACCINE

Title :

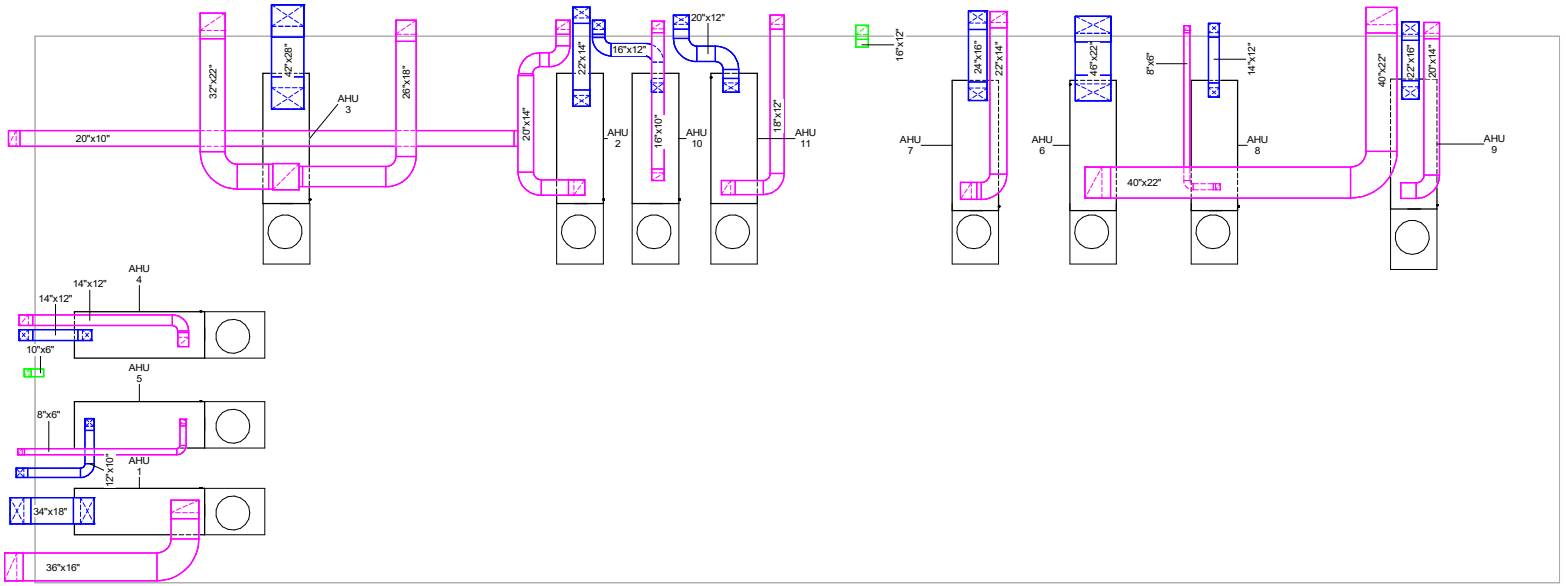
Air Terminal Layout

Revision Schedule		
Revision Number	Revision Description	Revision Date

Approved: IA	Cad By : HA
Checked: HA	
Scale : 1/8" = 1'-0"	

Remarks:

Drawing No:	Date:
A-02	Rev:



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Karachi
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Job :

SIAH LIVE VACCINE

Title :

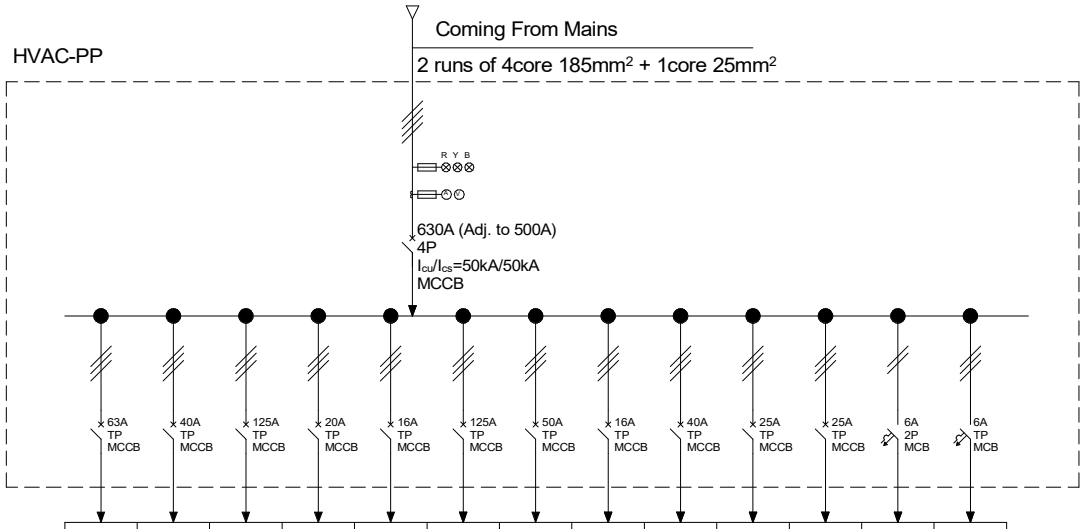
AHU Layout

Revision Schedule		
Revision Number	Revision Description	Revision Date
1	Tender Dwgs	03-09-2025

Approved: IA	Cad By : HA
Checked: HA	
Scale : 1/8" = 1'-0"	

Remarks:

Drawing No:	Date: 03-09-2025
A-03	Rev: 1



	RYB1	RYB2	RYB3	RYB4	RYB5	RYB6	RYB7	RYB8	RYB9	RYB10	RYB11	RY12	RYB13
Load Name	HVAC Unit-01	HVAC Unit-02	HVAC Unit-03	HVAC Unit-04	HVAC Unit-05	HVAC Unit-06	HVAC Unit-07	HVAC Unit-08	HVAC Unit-09	HVAC Unit-10	HVAC Unit-11	Exhaust Fan-01	Exhaust Fan-02
Wire Size	4x 16mm² + 1x 6mm²	4x 6mm² + 1x 4mm²	4x 50mm² + 1x 10mm²	4x 4mm² + 1x 4mm²	4x 2.5mm² + 1x 2.5mm²	4x 50mm² + 1x 10mm²	4x 10mm² + 1x 6mm²	4x 2.5mm² + 1x 2.5mm²	4x 10mm² + 1x 6mm²	4x 4mm² + 1x 4mm²	4x 4mm² + 1x 4mm²	2x 2.5mm² + 1x 2.5mm²	4x 2.5mm² + 1x 2.5mm²
Load (kW)	34.29	17.55	63.61	10.0	5.11	62.04	25.28	3.74	21.57	11.12	13.57	1.0	1.6

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Job :
SIAH LIVE VACCINE

Title :
SLD - HVAC Power Panel

Revision Schedule

Revision Number	Revision Description	Revision Date
1	Tender Dwgs	03-09-2025

Approved: IA	Drawn By : HA
Checked: HA	
Scale : 1 1/2" = 1'-0"	
Drawing No: A-04	Date: 03-09-2025
	Rev: 1

Self Contained Package Units Schedule

1	Air Handling Unit	AHU-01	AHU-02	AHU-03	AHU-04	AHU-05	AHU-06	AHU-07	AHU-08	AHU-09	AHU-10	AHU-11
2	Cooling Coil Load (Tons)	11.05	6.25	20.42	3.83	2.03	23.3	9.94	1.71	8.0	4.38	4.84
3	DX Coil Air Entering DB/WB (°F)	72.57/61.5	73.36/62.85	72.06/61.08	73.8/63.81	75.93/66.84	73.67/63.37	76.19/67.47	78.38/70.86	74.19/64.34	74.2/64.4	73.0/62.42
4	DX Coil Air Leaving DB/WB (°F)	53/52	53/52	53/52	53/52	53/52	53/52	53/52	53/52	53/52	53/52	53/52
5	Supply Airflow (CFM)	5200	2500	10000	1400	540	8800	2588	350	2758	1500	2000
6	Fresh Airflow (CFM)	317	278	500	200	150	1150	750	150	450	250	200
7	Outdoor Design Conditions (°F)	105 DB / 82.4 WB	105 DB / 82.4 WB	105 DB / 82.4 WB	105 DB / 82.4 WB	105 DB / 82.4 WB	105 DB / 82.4 WB	105 DB / 82.4 WB	105 DB / 82.4 WB	105 DB / 82.4 WB	105 DB / 82.4 WB	105 DB / 82.4 WB
8	Reheat Coil Size (MBH)	56.16	27	108	15	5.86	95	28	3.78	30.0	16.2	21.6
9	Reheat Coil Ent./Leaving Air Temperature (°F)	55/65	55/65	55/65	55/65	55/65	55/65	55/65	55/65	55/65	55/65	55/65
10	ESP (inwg)	2.0	3.5	3.5	1.5	1.5	2.0	3.5	3.5	3.5	1.5	1.5
12	Filtration	G4, F7, F9	G4, F7, F9	G4, F7, F9, H13	G4, F7, F9	G4, F7, F9	G4, F7, F9	G4, F7, F9, H13	G4, F7, F9	G4, F7, F9, H13	G4, F7, F9	G4, F7, F9
13	Remarks	AHU side Panel thickness: 50mm. Siemens Logo PLC (with 24V PSU) to be used as Micro Controller, to be installed in condensing unit electrical panel. Dual Fans & 2 stage reheat for Dual Circuit units. Duct temperature/rh transmitter and airflow switch must also be provided with the unit.										

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SIAH LIVE VACCINE

Title :

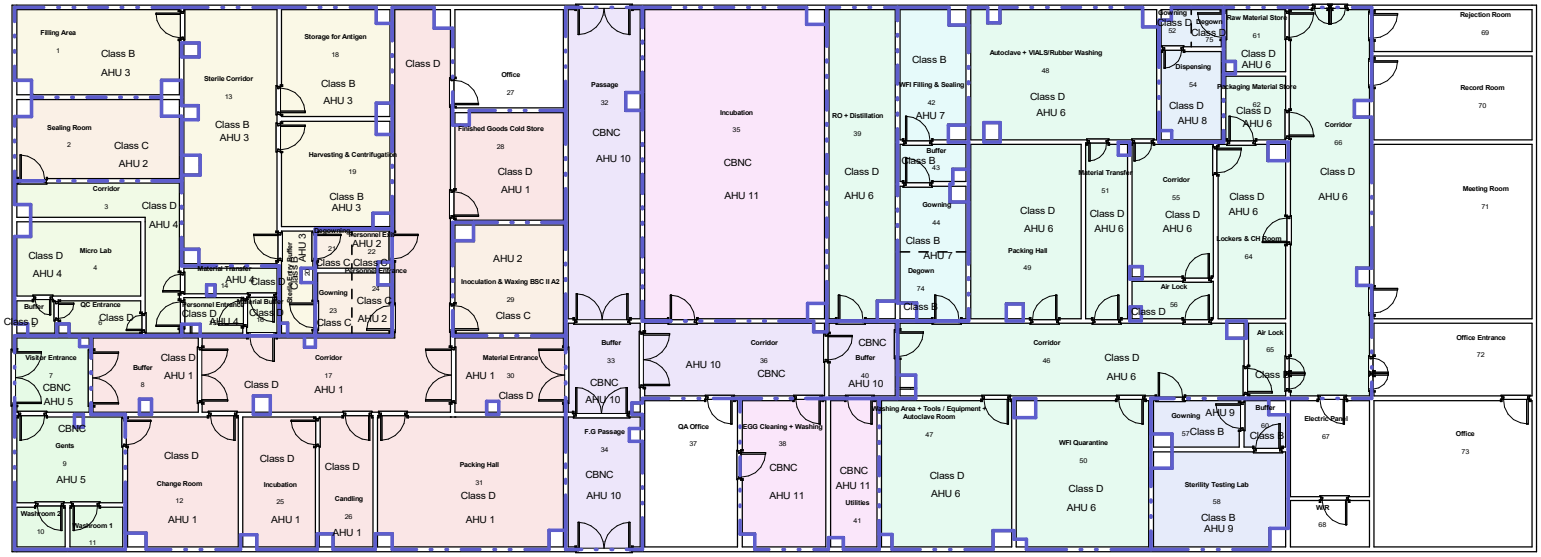
Equipment Schedule

Revision Schedule

Revision Number	Revision Description	Revision Date
1	Tender Dwgs	03-09-2025

Approved: IA	Drawn By : HA
Checked: SA	
Scale : 1 1/2" = 1'-0"	
Drawing No:	Date: 03-09-2025
A-05	Rev: 1

Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Zone 6
Zone 7
Zone 8
Zone 9
Zone 10
Zone 11



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Job :

SIAH LIVE VACCINE

Title :

Zoning

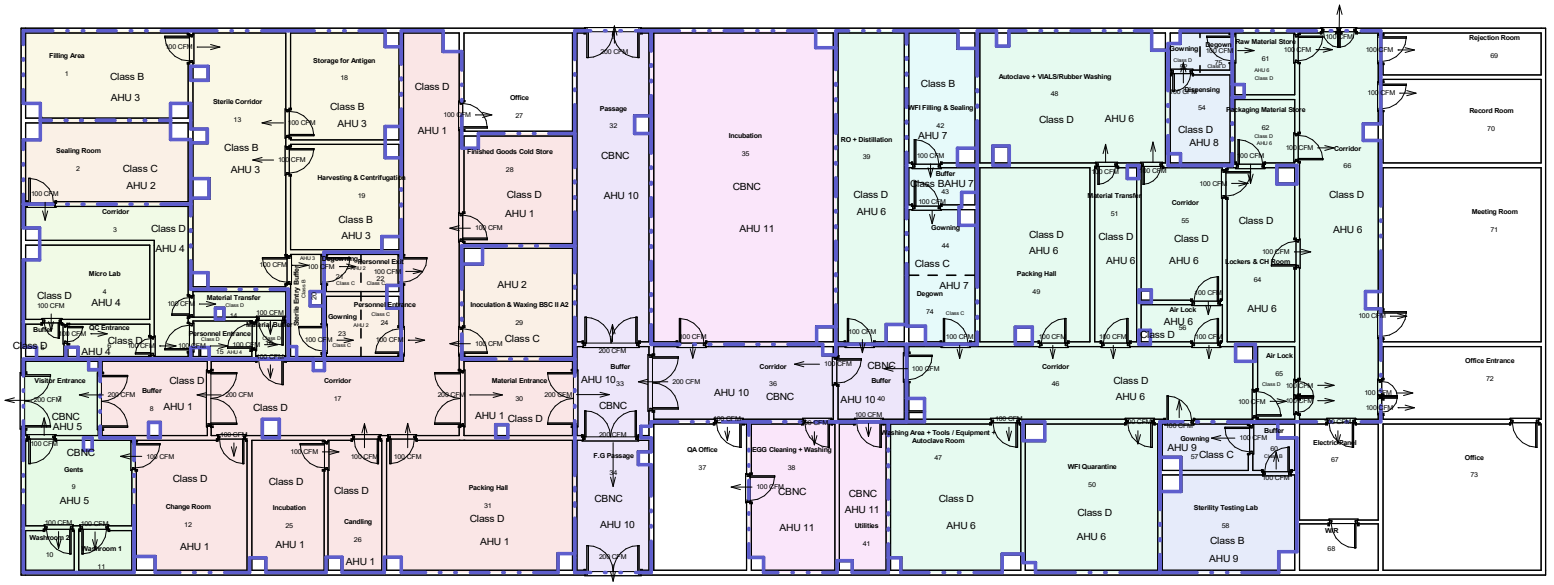
Revision Schedule		
Revision Number	Revision Description	Revision Date
1	Tender Dwgs	03-09-2025

Approved: IA	Cad By : HA
Checked: SA	
Scale : 1/8" = 1'-0"	

Remarks:

Drawing No:	Date: 03-09-2025
A-06	Rev: 1

Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Zone 6
Zone 7
Zone 8
Zone 9
Zone 10
Zone 11



CLIENT :

HVAC Consultants

Universal Engineering Services
Engineers & Planners

308 Al Amin Tower Gulshan-e-Iqbal Block-10
Karachi
Email: uni_engg_ser@yahoo.com

Job :

SIAH LIVE VACCINE

Title :

Airflow

Revision Schedule		
Revision Number	Revision Description	Revision Date
1	Tender Dwgs	03-09-2025

Approved: IA	Cad By : HA
Checked: SA	
Scale : 1/8" = 1'-0"	

Remarks:

Drawing No:	Date: 03-09-2025
A-07	Rev: 1

SCHEDULE OF REQUIREMENTS / BOQ

DATA SHEET / ASSIGNMENT INFORMATION

HVAC BOQ For LSD & BACTRIN UNITS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ITEM NO.	DESCRIPTION	QTY.	UNIT	MATERIAL		INSTALL. / LABOUR	
				UNIT RATE	AMOUNT	UNIT RATE	AMOUNT
				(Rs.)	(Rs.)	(Rs.)	(Rs.)
					(3) x (5)		(3) x (7)
1	Suppply & Installation of Self Contained Package Units with 50mm panel thickness as per attached specifications. The unit will be provided with Scroll compressors. The unit will have acrylic coating on coil fins. * See Equipment Schedule for further details						
a	AHU-01	1	No.				
b	AHU-02	1	No.				
c	AHU-03	1	No.				
d	AHU-04	1	No.				
e	AHU-05	1	No.				
f	AHU-06	1	No.				
g	AHU-07	1	No.				
h	AHU-08	1	No.				
i	AHU-09	1	No.				
j	AHU-10	1	No.				
k	AHU-11	1	No.				
l	AHU-12	1	No.				
m	AHU-13	1	No.				

2	Supply and Installation of Cabinet type Exhaust Fans with below specifications. Type :- Cabinet type Ex. Fan/Inline Duct Fan						
	a) Exhaust Fan 4500 CFM, ESP 1.0 inwg	1	No.				
	b) Exhaust Fan 1650 CFM, ESP 1.0 inwg	1	No.				
	C) Exhaust Fan 550 CFM, ESP 1.0 inwg	2	No.				
3	Supply and construction of RCC Foundation on proposed roof for Package units as per requirement. Hanging of Inline Duct Fans as required	1	Job				
4	Rigging and Shifting of HVAC Equipment to proposed rooftop location	1	Job				
5	Supply, Fabrication, Jointing and Installation of 20mm PIR Duct Sheet as per standard for supply air ducting, plenums, fresh and exhaust air duct etc. making connection, MS support / hangers turning vanes, elbow tees etc. with volume control dampers and duct test holes at adequate location for proper balancing of the air side system and other necessary fittings / accessories complete in all respect as described in specification, schedule and drawings and as approved by the Engineer. Make: Kingspan or Equivalent	20500	Sqft				
6	Cladding of exposed ducting as per specifications, complete in all respects.	10200	Sqft				
7	Supply and Installation of Flexible Ducts Connector for connection from Duct to AHU's, complete with all respect.		Rft				
8	Insulated Flex Duct 8"	110	Rft				
9	Insulated Flex Duct 12"	120	Rft				
10	Supply, Installation and fixing of following type air devices extruded aluminium and powder coated color (approved by the Architect) including connections with air ducts and support arrangements as described in specifications, drawings complete in all respect and as approved by the Engineer.						
	a) Supply/Return Air Square Diffuser and Grills, (where applicable) (Similar to T&B Model AME 4-Way) with VCD	12804	SqInch				

11	Supply and Installation of heavy gauge G.I. sheet metal gear operated, aerofoil blade manual volume control damper with adequate numbers duct test holes, complete in all respect and as required by the independent testing and balancing agency and to the satisfaction of the Engineer.	3912	SqInch				
12	Supply and Installation of Air Terminal HEPA Filters H14 as per below size						
	a) Hepa Filter Size:- 15 x 15 x 6 Inch	13	Nos.				
	b) Hepa Filter Size:- 18 x 18 x 6 Inch	25	Nos.				
	c) Hepa Filter Size:- 24 x 24 x 6 Inch	32	Nos.				
13	Supply and Installation of Air Terminal HEPA Filters Housing in MS with powder coating as per below size						
	a) Size 15 x 15 x 6 Inch	13	Nos.				
	b) Size 18 x 18 x 6 Inch	25	Nos.				
	c) Size 24 x 24 x 6 Inch	32	Nos.				
14	Supply and Installation of Perforated Grills for Air Terminal HEPA Filters Housing in MS with Powder coating as per below size						
	a) HEPA Size 19 x 19 - 13#	4693	Sqinch				
	b) HEPA Size 22 x 22 - 25#	12100	Sqinch				
	c) HEPA Size 28 x 28 - 32#	25088	Sqinch				
15	Supply & Installation of wall / Floor mounted HVAC Panel IP-54 for HVAC Equipment, with following safety devices including Lugs and termination & Tagging, complete in all respect. with Measuring Instrument / Meter with selector Higher Conductivity & 99.9% Tin Coated Bus bar. * for details see SLD HVAC Panel	1	No.				
	Supply & Installation of Electrical wiring with proper laying in Cable Tray / Electrical PVC conduit including MS supports, for HVAC Equipments from MCC Panel with following specs, Complete in all respect.						
	a) 2x (4 core, 240mm², PVC/PVC Cu Cable with 1 core 70mm² as ECC for main feeder cable for HVAC Panel)	50	M				
	b) 4 core, 10mm², PVC/PVC Cu Cable with 1 core 6mm² as ECC for AHU-01 from HVAC Panel	20	M				
	c) 4 core, 16mm², PVC/PVC Cu Cable with 1 core 6mm² as ECC for AHU-02 from HVAC Panel	20	M				
	d) 4 core, 10mm², PVC/PVC Cu Cable with 1 core 6mm² as ECC for AHU-03 from HVAC Panel	15	M				
	e) 4 core, 16mm², PVC/PVC Cu Cable with 1 core 6mm² as ECC for AHU-04 from HVAC Panel	18	M				
	f) 4 core, 2.5mm², PVC/PVC Cu Cable with 1 core 2.5mm² as ECC for AHU-05 from HVAC Panel	10	M				

16	g) 4 core, 4mm², PVC/PVC Cu Cable with 1 core 4mm² as ECC for AHU-06 from HVAC Panel	12	M				
	h) 4 core, 4mm², PVC/PVC Cu Cable with 1 core 4mm² as ECC for AHU-07 from HVAC Panel	15	M				
	i) 4 core, 2.5mm², PVC/PVC Cu Cable with 1 core 2.5mm² as ECC for AHU-08 from HVAC Panel	15	M				
	j) 4 core, 50mm², PVC/PVC Cu Cable with 1 core 10mm² as ECC for AHU-09 from HVAC Panel	25	M				
	k) 4 core, 4mm², PVC/PVC Cu Cable with 1 core 4mm² as ECC for AHU-10 from HVAC Panel	18	M				
	l) 4 core, 10mm², PVC/PVC Cu Cable with 1 core 6mm² as ECC for AHU-11 from HVAC Panel	20	M				
	m) 4 core, 6mm², PVC/PVC Cu Cable with 1 core 4mm² as ECC for AHU-12 from HVAC Panel	25	M				
	n) 4 core, 16mm², PVC/PVC Cu Cable with 1 core 6mm² as ECC for AHU-13 from HVAC Panel	30	M				
	o) 4 core, 2.5mm², PVC/PVC Cu Cable with 1 core 2.5mm² as ECC for Ex. Fan (4500 CFM) from HVAC Panel	15	M				
	p) 4 core, 2.5mm², PVC/PVC Cu Cable with 1 core 2.5mm² as ECC for Ex. Fan (1613 CFM) from HVAC Panel	15	M				
	q) 2 core, 2.5mm², PVC/PVC Cu Cable with 1 core 2.5mm² as ECC for Ex. Fan (530 CFM) from HVAC Panel	20	M				
17	Supply, installation of MS Powdered coated perforated cable tray in 16gage with 18 guage cover for electrical wiring of AHU's						
	a) Cable Tray szie :- 12"x 6"	80	M				
18	Supply and Installation of Conduits for electrical wiring for HVAC Circuits as required	1	Lot				
19	Testing, Airbalancing and commissioning of installed AHUs	1	Job				
20	Supply and Installation of Plastic tags for all equipments identification and installed with chains. Identifications colour coding, stenciling and metallic stickers / name plate with required data on all piping, ducting, equipment and materials etc. as required by the Engineer, complete in all respect	1	Job				
21	Painting of all equipment, hangers, foundation supports, pipes, ducts, colour bends etc. complete in all respect to the satisfaction of the Engineer.	1	Job				
22	Providing of the AutoCAD (latest version) as-built drawings and 03 number of sets and soft copies on CD's as specified, complete in all respect and to the satisfaction of the Engineer.	1	Job				

23	Supply of operation and maintenance manuals with complete catalogues, manufacturer's maintenance and operation manuals in the form specified in the documents / specification and to the satisfaction of the Engineer. Complete in all respect and required.	1	Job				
24	Cost of two months test run each in the peak summer and winter season as reauired by the Consultant / Enaineer or end user.	1	Job				
25	Supply and Installation of PVC sleeves for pipes and G.I. sheet sleeves for duct work in all masonry and RCC structure as required for the system installation.	1	Job				
26	Supply & Installation of Desktop Computer with SCADA Software to connect all Package Unit's Logo PLC with centralized SCADA workstation including network switches, CAT6 Cable, Programming & Interfacing, complete in all respect.	1	Job				
		Material Cost				**Labor Cost**	
		GST 18%				**SRB 15%**	
		Total Cost					

List of Drawings	
A-01	Air Terminals Layout
A-02	Ducting Layout
A-03	Zoning Layout
A-04	Airflow Layout
A-05	Equipment Schedule
A-06	SLD - HVAC Power Panel
A-07	AHU Layout

CLIENT :

HVAC Consultants

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Engineers & Planners

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Job :

Project Name

Title :

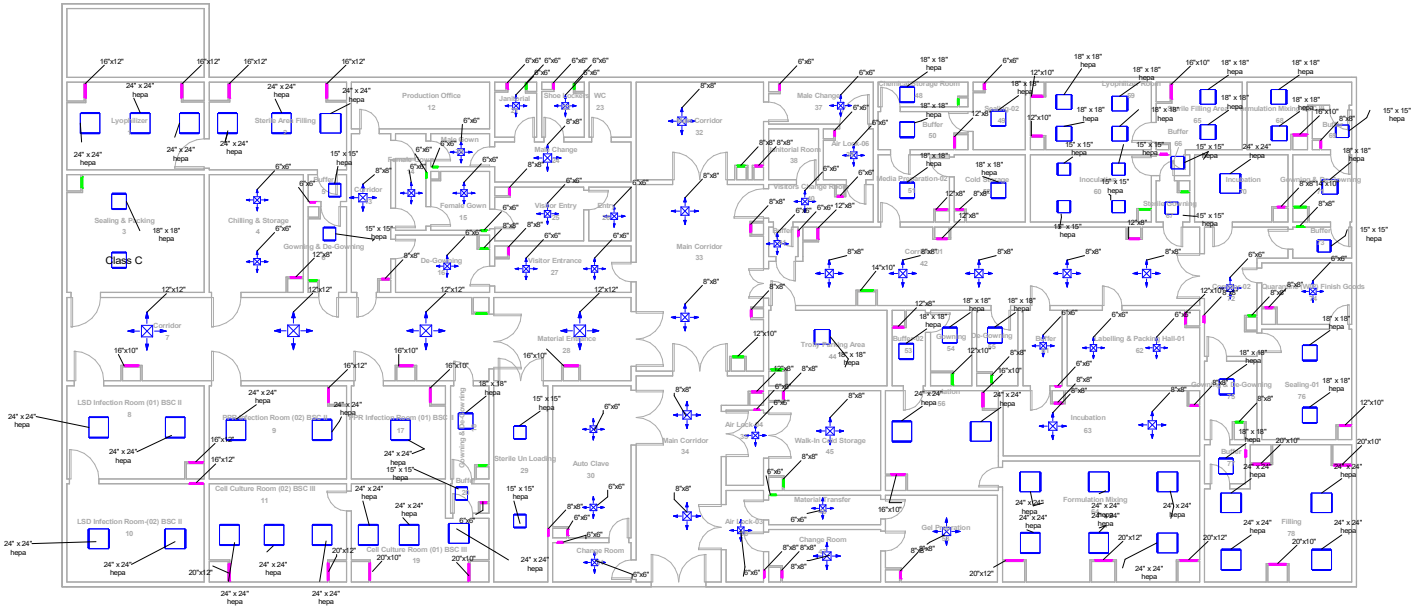
List of Drawings

Revision Schedule		
Revision Number	Revision Description	Revision Date
1	Tender Dwgs	03-09-2025

Approved: IA	Cad By : HA
Checked: SA	
Scale :	

Remarks:

Drawing No:	Date: 03-09-2025
A-00	Rev: 1



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Job :

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Title :

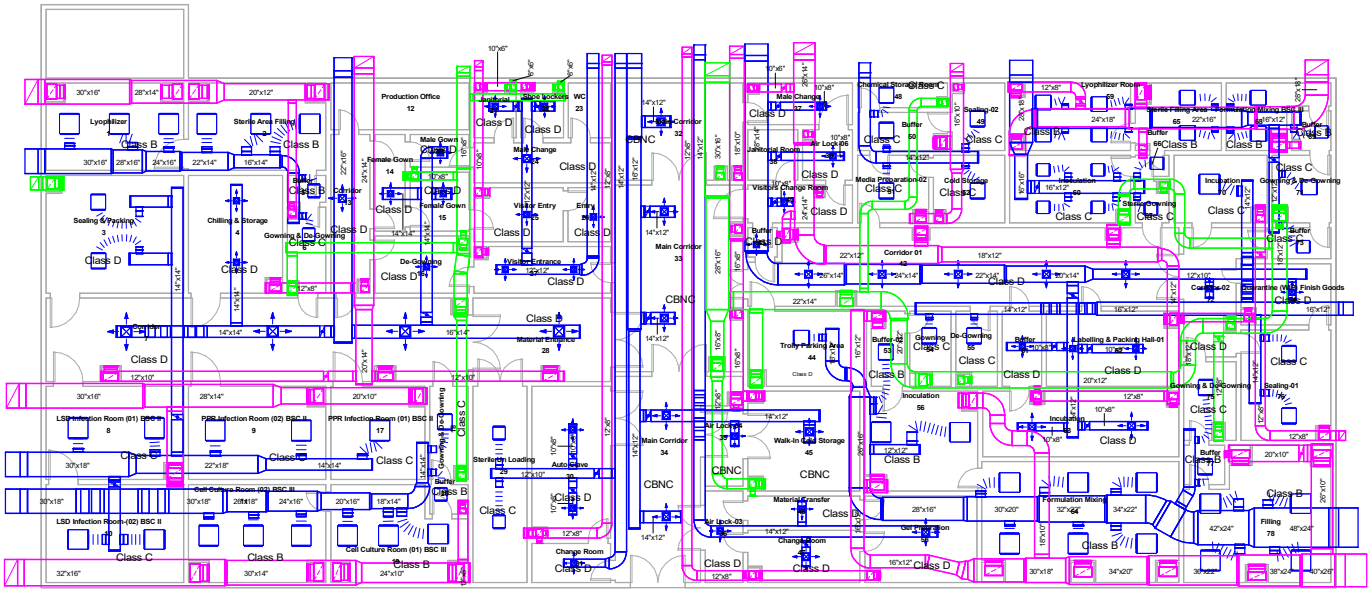
Air Terminals Layout

Revision Schedule		
Revision Number	Revision Description	Revision Date
1	Tender Dwgs	03-09-2025

Approved: IA	Cad By : HA
Checked: SA	
Scale : 1/8" = 1'-0"	

Remarks:

Drawing No:	Date: 03-09-2025
A-01	Rev: 1



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Job :

Project Name

Title :

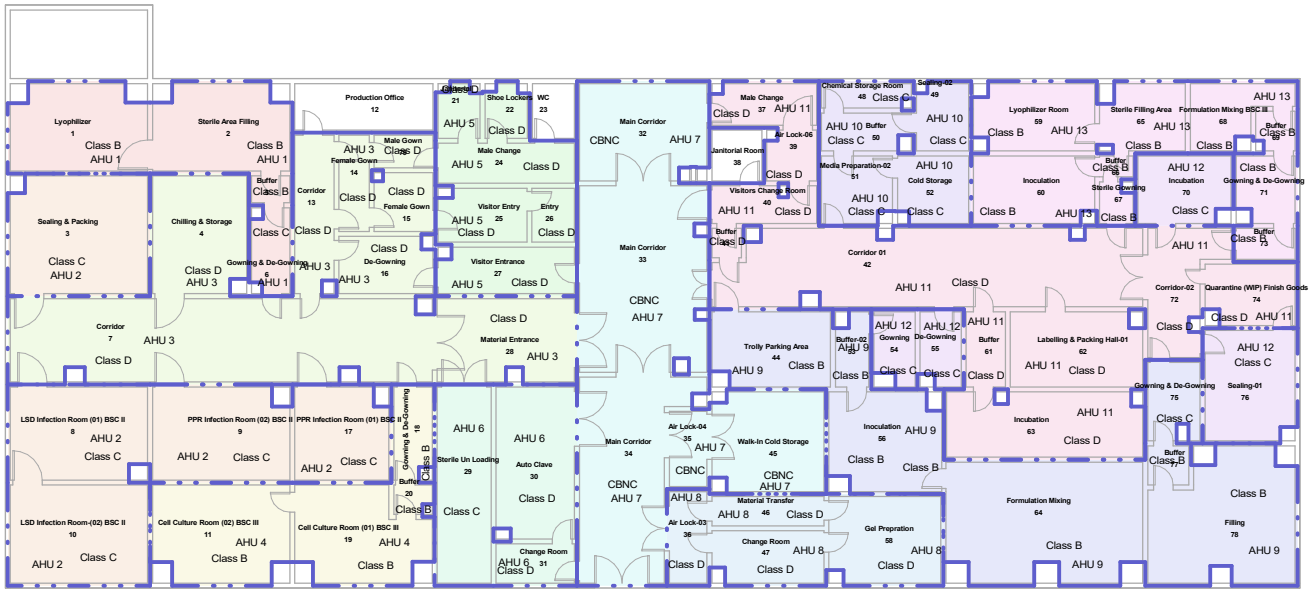
Ducting Layout

Revision Schedule		
Revision Number	Revision Description	Revision Date
1	Tender Dwgs	03-09-2025

Approved: IA	Cad By : HA
Checked: SA	
Scale : 1/8" = 1'-0"	

Remarks:

Drawing No:	Date: 03-09-2025
A-02	Rev: 1



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Job :

Project Name

Title :

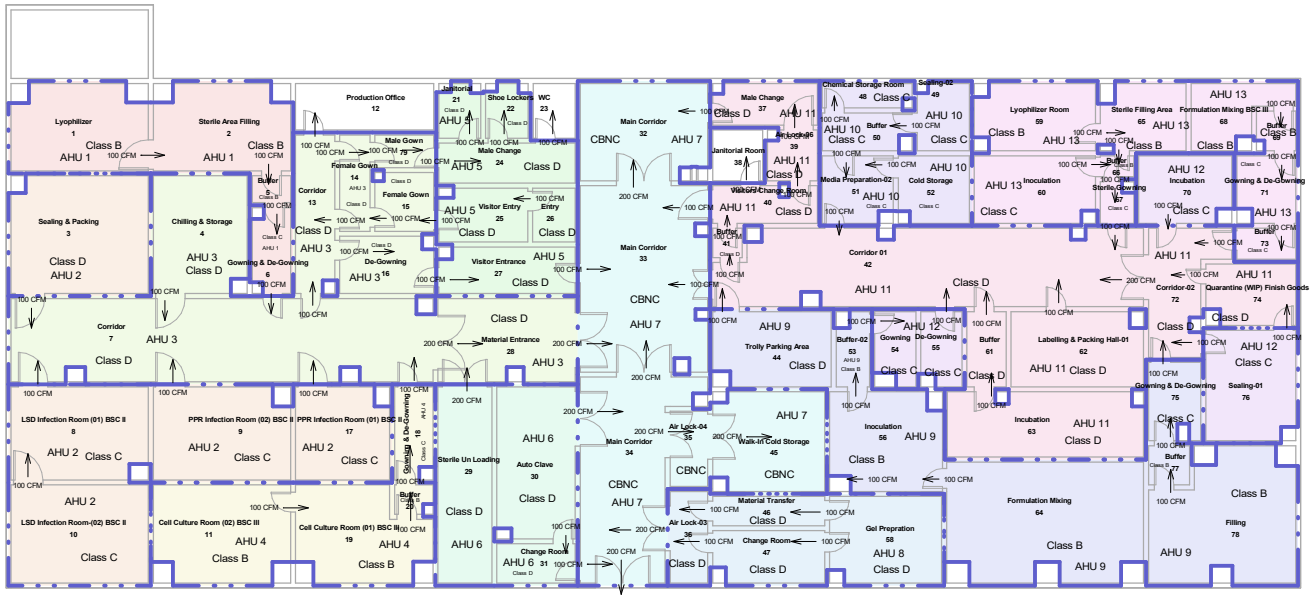
Zoning Layout

Revision Schedule		
Revision Number	Revision Description	Revision Date
1	Tender Dwgs	03-09-2025

Approved: IA	Cad By : HA
Checked: SA	
Scale : 1/8" = 1'-0"	

Remarks:

Drawing No:	Date: 03-09-2025
A-03	Rev: 1



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Job :

Project Name

Title :

Airflow Layout

Revision Schedule		
Revision Number	Revision Description	Revision Date
1	Tender Dwgs	03-09-2025

Approved: IA	Cad By : HA
Checked: SA	
Scale : 1/8" = 1'-0"	

Remarks:

Drawing No:	Date: 03-09-2025
A-04	Rev: 1

Self Contained Package Units Schedule

1	Air Handling Unit	AHU-01	AHU-02	AHU-03	AHU-04	AHU-05	AHU-06	AHU-07	AHU-08	AHU-09	AHU-10	AHU-11	AHU-12	AHU-13
2	Cooling Coil Load (Tons)	8.27	13.76	7.64	10.12	3.99	5.44	4.14	4.18	21.59	4.5	8	8.42	16.09
3	DX Coil Air Entering DB/WB (°F)	72.4/61.1	75.34/61.14	73.36/62.96	73.1/62.49	77/68.6	79.5/72.6	73.2/62.5	77.8/70.14	73.2/62.5	75.1/65.9	73.2/62.5	79.1/72.1	76.0/67.46
4	DX Coil Air Leaving DB/WB (°F)	53/52	53/52	53/52	53/52	53/52	53/52	53/52	53/52	53/52	53/52	53/52	53/52	53/52
5	Supply Airflow (CFM)	4050	4000	3050	4250	950	1000	1700	900	8900	1350	3283	1600	4250
6	Fresh Airflow (CFM)	202	945	340	405	320	503	174	357	900	300	337	767	1200
7	Outdoor Design Conditions (°F)	105 DB / 82.5 WB	105 DB / 82.5 WB	105 DB / 82.5 WB	105 DB / 82.5 WB	105 DB / 82.5 WB	105 DB / 82.5 WB	105 DB / 82.5 WB	105 DB / 82.5 WB	105 DB / 82.5 WB	105 DB / 82.5 WB	105 DB / 82.5 WB	105 DB / 82.5 WB	105 DB / 82.5 WB
8	Reheat Coil Size (MBH)	43.74	43.2	32.94	45.9	10.26	10.8	18.36	9.72	96.12	14.58	35.45	17.228	45.9
9	Reheat Coil Ent./Leaving Air Temperature (°F)	55/65	55/65	55/65	55/65	55/65	55/65	55/65	55/65	55/65	55/65	55/65	55/65	55/65
10	ESP (inwg)	3.5	3.5	2	3.5	1.5	3.5	1.5	1.5	4	3.5	2.5	3.5	4
12	Filtration	G4, F7, F9, H13	G4, F7, F9	G4, F7, F9, H13	G4, F7, F9, H13	G4, F7, F9, H13	G4, F7, F9, H13	G4, F7, F9	G4, F7, F9, H13	G4, F7, F9, H13	G4, F7, F9	G4, F7, F9, H13	G4, F7, F9	G4, F7, F9, H13
13	Remarks	AHU side Panel thickness: 50mm. Siemens Logo PLC (with 24V PSU) to be used as Micro Controller, to be installed in condensing unit electrical panel. Dual Fans & 2 stage reheat for Dual Circuit units. Duct temperature/rh transmitter and airflow switch must also be provided with the unit.												

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Job :

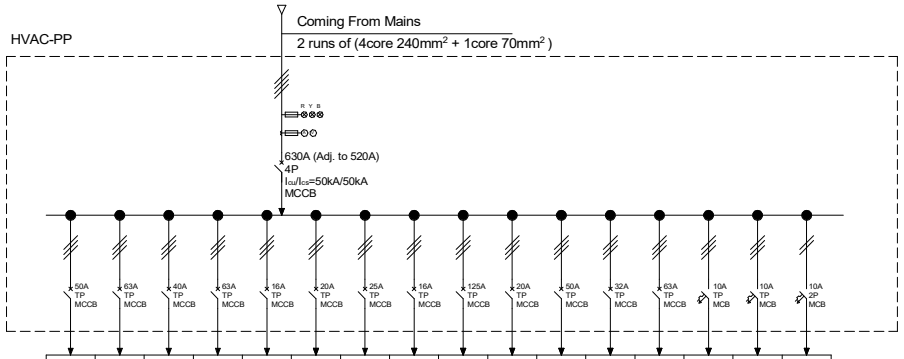
Project Name

Title :

Equipment Schedule

Revision Schedule		
Revision Number	Revision Description	Revision Date
1	Tender Dwgs	03-09-2025

Approved: IA	Drawn By : HA
Checked: SA	
Scale : 1 1/2" = 1'-0"	
Drawing No:	Date: 03-09-2025
A-05	Rev: 1



	RYB1	RYB2	RYB3	RYB4	RYB5	RYB6	RYB7	RYB8	RYB9	RYB10	RYB11	RYB12	RYB13	RYB14	RY15	B15R16
Load Name	HVAC Unit-01	HVAC Unit-02	HVAC Unit-03	HVAC Unit-04	HVAC Unit-05	HVAC Unit-06	HVAC Unit-07	HVAC Unit-08	HVAC Unit-09	HVAC Unit-10	HVAC Unit-11	HVAC Unit-12	HVAC Unit-13	Exhaust Fan-01	Exhaust Fan-01	Exhaust Fan-02
Wire Size	4x 10mm² + 1x 6mm²	4x 16mm² + 1x 6mm²	4x 10mm² + 1x 6mm²	4x 16mm² + 1x 6mm²	4x 2.5mm² + 1x 2.5mm²	4x 4mm² + 1x 4mm²	4x 4mm² + 1x 4mm²	4x 2.5mm² + 1x 2.5mm²	4x 50mm² + 1x 10mm²	4x 4mm² + 1x 4mm²	4x 10mm² + 1x 6mm²	4x 6mm² + 1x 4mm²	4x 16mm² + 1x 6mm²	4x 2.5mm² + 1x 2.5mm²	4x 2.5mm² + 1x 2.5mm²	2x 2.5mm² + 1x 2.5mm²
Load (kW)	26.67	32.49	21.25	29.48	8.9	10.7	12.05	8.78	60.53	9.53	22.6	17.1	36.05	1.5	1.0	1.0

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Job :

Project Name

Title :

SLD - HVAC Power Panel

Revision Schedule		
Revision Number	Revision Description	Revision Date
1	Tender Dwgs	03-09-2025

Approved: IA	Cad By : HA
Checked: SA	
Scale : 1 1/2" = 1'-0"	

Remarks:

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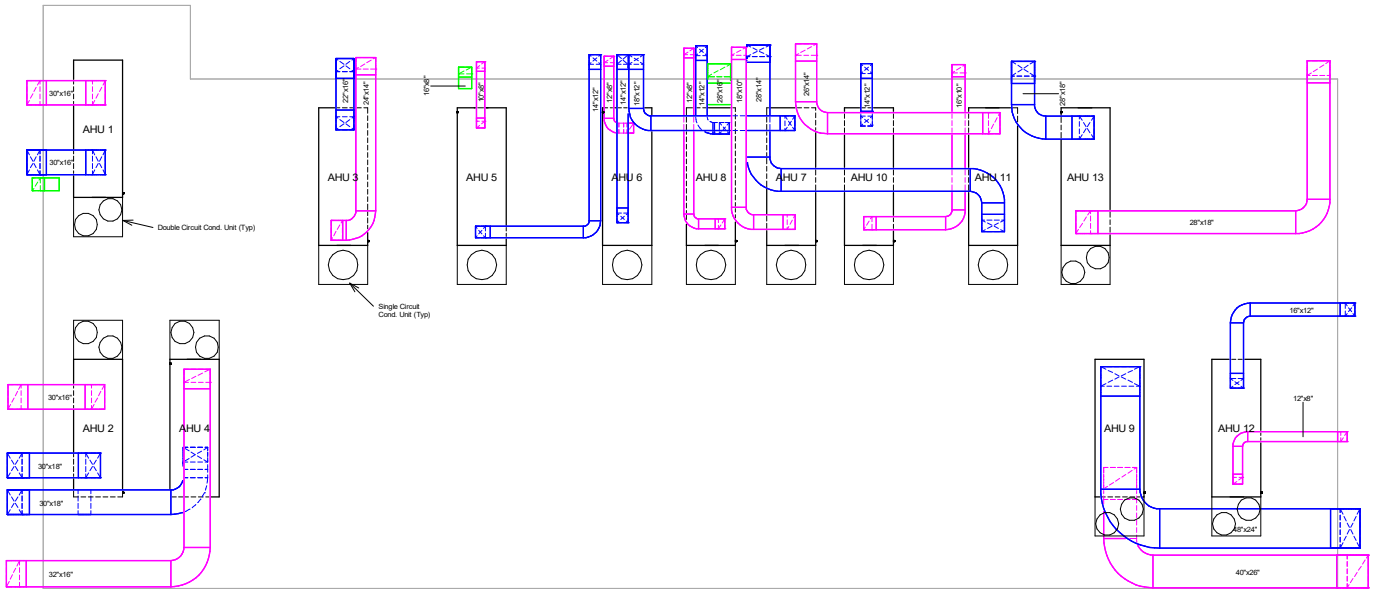
A-06	Rev: 1



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Job :

Project Name

Title :

AHU Layout

Revision Schedule		
Revision Number	Revision Description	Revision Date
1	Tender Dwgs	03-09-2025

Approved: IA	Cad By : HA
Checked: SA	
Scale : 1/8" = 1'-0"	

Remarks:

Drawing No:	Date: 03-09-2025
A-07	Rev: 1

2021

General Specifications

Contents

TECHNICAL SPECIFICATION - HVAC WORKS

1.0 GENERAL:

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

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

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

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

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

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

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

between opening / shaft / wall and pipe/duct shall also be fire sealed through fire stopping material.

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

1.1 EQUIPMENT AND MATERIAL:

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

(b) Approval of Equipment and Material:
Before starting installation of any material or equipment, the Contractor shall submit to the Client / Project Managers for approval working drawings of all areas and lists of materials and equipment to be incorporated in the work. The layout drawings shall include a plan and elevations of the proposed piping, ductwork and equipment to establish that the equipment will fit in the allotted space with clearances for installation and maintenance. The drawings shall show proposed details for attachment anchoring, and hanging to structural framing of the building; vibration isolation units; foundation and support; location and size of sleeves and prepared openings for passage of pipes and ducts. If departures from the contract drawings are deemed necessary by the Contractor, details of such departures including changes in related portions of the project and the reasons thereof shall be submitted with the drawings. Approved departures shall be made at no additional cost to the Owner. A complete electrical connection diagram, for each electrically controlled component having more than automatic or manual control device, shall be submitted to the Consultant for approval in addition to the automatic temperature control diagram required hereinafter. Wiring diagrams shall identify each component and one diagram shall show all interconnected or interlocked components. The lists of materials and equipment shall be supported by sufficient descriptive material, such as catalogs, diagrams, performance curves, charts, layout

drawings and other data published by the manufacturer, to demonstrate conformance to the specification requirements; model numbers alone will not be acceptable. The data shall also include the name and address of the nearest service and maintenance organization that regularly stock repair parts. Listings of items that function as parts of an integrated system shall be furnished at one time. One copy of the layout drawings, wiring diagrams and lists will be returned, marked to indicate approval.

All material shall be submitted to the Client / Project Managers for approval and only approved material shall be supplied to the site.

1.2 SAMPLES:

The contract shall provide at his cost, samples of material, instruments, guages 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 smaples shall include but not limited to:

1. G.I Sheet, each gauge to be used
2. Pipes and Fittings
3. Duct Insulation, and Covering
4. Pipe Insulation and Covering
5. Insulation Adhesive and Tapes
6. Air devices (Terminal air diffusers, Grilles, Registers)
7. Louvers
8. All types of Dampers
9. Power and Control Cables
10. Vibration Isolating Springs, Pipe Hangers, Duct Hangers and Rollers
11. Copper Piping, Condensate Drain Piping,

2.0 AIR HANDLING UNITS:

2.1 GENERAL:

The Contractor shall furnish and install DX Air Handling with air cooled condensing Unit as given in the Schedule Sheet. The units shall be supplied in strict accordance with these specifications. The Air Handling Unit shall consist of mixing box, pre-filter, bag filter, hepa filter, moisture eliminator sections, cooling coil, Fan & discharge section as bare minimum. The units shall be provided as per List of Approved Manufacturer's.

Air handling units shall be low pressure or high-pressure single zone draw-through type as indicated on the Schedule Sheet. Units shall be complete with airtight insulated fan coil section, waterproof drain pan, cooling coils, piping, fans, motor, variable frequency drive, hepa, bag & flat filters, moisture eliminator, sight glass, motor termination box, air inlet / outlet dampers if required for stable fan operation, removable panels, access doors, wherever required for servicing, combination filter/mixing box, spring vibration isolators, and any other appurtenances necessary for satisfactory operation. Contractor shall be duly responsible for verifying the dimensional suitability of the air-handling unit in the space allocated, as shown on the drawings.

2.2 UNIT CASING:

Unit Casing shall be product of a Standard Manufacturer. Unit casing shall be of double skin design, with an insulation panel sandwiched between two galvanized steel sheets, of quality construction, braced and reinforced for smooth operation. The minimum thickness of inner and outer sheet shall be 1.0 mm and 0.8 mm. Fan and coil section shall be constructed of not lighter than 18 gauge, 0.0516 inch (1.31 mm) nominal thickness, galvanized steel Removable panels shall provide access to all internal parts. An insulated drain pan shall be provided under the fan & coil section and shall be coated with waterproofing material. Drain pan shall have drain connections on both sides. The unit casing shall be of double-skin type, with the outer and inner skins fabricated of hot-dip galvanized steel and with the outer skin powder coated after manufacture and shall be enamel baked. The panels shall be supplied in 50-mm thickness.

The panels shall be insulated with a rigid factory injected polyurethane insulation layer of at least 45 kg/m^3 density, meeting the NFPA-90A Flame speed and smoke generation requirements.

2.3 FANS:

All fans shall be fully enclosed centrifugal, single width single inlet or double width, double inlet, class I, II or III as required or indicated for the design system pressure. Fans shall be capable of discharging the required volume of air against the duct work system resistance plus the resistance through the unit itself. Contractor shall add the resistance through the unit to the external static pressure indicated on the Schedule Sheet for selecting the fans.

Impeller wheels shall be of the non-overloading type, shall be rigidly constructed, accurately balanced both statically & dynamically and shall be free from objectionable noise or vibration. Fan blades may be forward curved, design. The fan shall bear AMCA certified sound rating seal.

Fan wheels 36 inches (910 mm) or less in diameter may have one or more extra-long bearing between the fan wheel and the drive.

The bearings shall be permanently lubricated, sleeve type, self-aligning and self-oiling with adequate reservoir, or self-aligning ball type with accessible grease fittings. The fan shaft shall be of steel, accurately finished. Fans shall not pass through their first critical speed at any catalogue RPM. Motors shall be mounted on an adjustable mount furnished by the unit manufacturer.

Motors up to and including 1 HP shall be 220/50/1, motors larger than 1 HP shall be 400V/50/3. Drive shall be selected at a service factor of 1.2 MHP.

2.4 MIXING BOXES:

Medium capacity combination filter mixing box shall be furnished for all air handling units not operating on 100% fresh air, such that the filter velocity is in accordance with the velocity specified. Access to the filter shall be provided on both sides. Filter shall be fit a snugly to prevent air by passing. Damper arrangement shall be parallel type and set up for merging of air streams inside the box. Damper blade rods shall rotate on rustproof bushings. Each box shall be equipped with duct connection flanges and necessary fastener holes. Mixing box shall be the manufacturer's standard product.

2.5 ELECTRICAL MOTORS:

The electric motors shall be of the type and sizes as specified for air-conditioning equipment and should comply with rules of electrical machines as stated in the VDE0530/59 and BS 2613:1957 specifications. The motors offered should have output rating as specified & should meet system requirements. Motors shall be of acceptable manufacturer.

Motor shall be supplied with variable frequency drive. Generally, all motors shall be constant speed, 3 phase, squirrel cage induction type unless otherwise specifically noted and remarked in schedules and drawings.

The motors offered should be for a supply of 400 Volts, 3 phase, 50 Hertz, and should be able of giving the rated output at + 5% the rated voltage and frequency.

The motors shall be suitable for and able to give the required output under site conditions i.e. maximum ambient temperature or 120^{o}F. (50^{o}C.) and altitude 1700 feet (518 meters).
The motors, where specified to be single phase, should be suitable for operation on 220 + 5% Volts, 50 Hertz AC System.

The motors shall have tropicalized Class 'F' insulation and fungus proof. Unless otherwise specified the motor shall have drip proof construction for indoor

installation, and totally enclosed weatherproof, fan cooled construction for outdoor installation.

All motors should be arranged for quiet operation and guaranteed to give the required output and fulfil the requirements of the machinery without producing any sound audible outside the AHU / Machine Room.

2.6 COILS:

The Contractor shall ensure proper selection of DX - Coil to provide the required heat transfer capacity, and shall submit selection data as proof of the same.

Coils shall be removable from the unit without dismantling the entire unit. Provision for removing the coil from unit top shall also be provided. Coils shall have continuous plate fin surface, with seamless copper tubes expanded into or positively bounded to aluminum fin collars. Casings shall be of galvanized steel. Each coil shall be leak-tested before shipment.

Coils shall be selected as per manufacturer's recommendations and shall be capable of providing the indicated capacity. Tubes shall be correctly circuited for proper water velocity, without excessive pressure drop.

All coils shall be of the cleanable and drainable type with removable gasket headers for complete access to the tubes for mechanical cleaning. Design air flow shall not exceed 500 fpm. (2.5 m/sec).

2.7 AIR FILTERS:

The following types of filters shall be installed where indicated on the air handling units and specified herein:

Sectional Cleanable Filters shall be 2 inch (50 mm) thick, permanent, viscous impingement, washable, all metal, and panel type. Media shall be 14 mesh (0.6 mm pitch) Aluminum screen arranged in alternate layers of flat and crimp screens, four layers of each per inch, 1/8 inch (3mm) reinforcing rod for positive media support, and enclosed in a frame of 16gauge (1.6 mm) Aluminum Sheeting with flush mitered corners. Resistance to airflow of a clean filter shall not exceed 0.12 inch w.g. (30 Pg) at 3.6 CFM per sq. inch (0.011 m^3/sec/sq. Cm.) of net face area.

Holding frames shall be factory built of 16 gauge (1.6 mm) steel 'T' section construction with felt air seal, inter-locking edges and filter locking device. Viscous adhesive shall be provided in 5 gallon containers in sufficient quantity for 12 cleaning operations. One washing and charging tank shall be provided for every 100 filter section or fraction thereof. Each washing and charging unit shall consist of a tank and rock mounted on legs. The drain rack shall be provided with dividers and partitions to properly support the filter in the draining position.

Bag filters shall not be less than, +95% against ASHRAE Standard 52-76/ EN 779/ atmospheric Dust SPOT test method average efficiency. Bag Filters shall be extended surface pocket type filter inserts having long service life with

high and constant dust extraction efficiencies, high stability of filter bags and low pressure loss even under large air flows. Filter media shall be manufactured from 100% endless fiber synthetic spun bonded polypropylene, which shall be ultrasonically bonded to form an impermeable seal. The media shall be sealed to longitude internal separator strips and sealed around the edge of each pocket.

2.8 NOISE LEVEL:

All air handling units shall be selected to provide noise level of not more than NC 40 in the air-conditioned space. The Contractor shall be responsible for evaluation of the noise level of the AHU and to incorporate sound attenuators, if required, to provide the noise level specified in the space, no additional cost and no variation or claim shall be entertained in this regard. The Contractor is directed to refer to specifications for "ACOUSTIC DUCT LINING", and to ensure the inclusion of all necessary acoustic attenuators to achieve the desired performance.

2.9 CONDENSING UNIT:

Condensing unit shall be air-cooled unit install in the locations and manner shown on the plans. The units shall be properly assembled and tested at the factory. These shall be designed for use with Refrigerant R 410A or any other ozone friendly refrigerant. Nominal unit electrical characteristics shall be 400 volts, 3 phase 50 Hertz.

Condenser coil shall be of nonferrous construction. Coil shall have aluminum plate fins, mechanically bonded to seamless copper tubes. Coil shall be circuited for subcooling. Coil and fins shall have heresite coating or equal approved anticorrosion protective coating on condenser fins and coils factory applied.
All compressors shall have five years guarantee.

Condenser Fans and Motors shall be direct driven, propeller type fans arranged for vertical discharge. Condenser fan motors shall have inherent protection, and shall be of the permanently lubricated type, resiliently mounted. Each fan shall have a safety guard. Controls shall be included for cycling fans for intermediate season operation.

Compressors shall be of hermetic design with external spring isolators and shall have an automatically reversible oil pump. Compressor shall unload in response to suction pressure down to 25% of full capacity in 3 steps minimum for partial load operation. Compressor shall be located in a section separated from condenser fans and coil.
Multiple compressor units shall have step-start fans and coils. Compressor motor shall have part-winding start.

Controls shall be factory wired and located in a separate enclosure. Safety devices shall consist of high and low pressure switches and compressor overload devices. Unit wiring shall incorporate a positive acting timer to

prevent short cycling of compressor if power is interrupted. Timer shall prevent compressor from restarting for approximately 5 minutes after shutoff. Units shall be factory wired to operate on single pump out control.

Casing shall make unit fully weatherproof for outdoor installation. Casing shall be of galvanized steel, zinc phosphatized and finished with baked enamel. Openings shall be provided for power and refrigerant connections. Panel shall be removable to provide access for servicing.

2.10 INSTALLATION:

2.10.1 General: The Contractor shall be responsible for installation of the Air Handling Units, as shown on the drawings, complete in all respects and as per satisfaction of the Consultants. The installation shall be carried out complete in all respects as per recommendations of the manufacturer and as specified herein. Complete refrigerant piping, duct connections, flexible connections, electrical connections, drain connections, etc. shall be done by the Contractor, complete in all respects.

2.10.2 Foundation: Foundation shall consist of 4" (100 mm) concrete pads constructed of 1:2:4 cement concrete. The foundation shall be isolated from the structure and AHU / machine room floor by using 2" (50 mm) thick higher density cork sheet. The foundation shall be finished with 3/16" thick cement plaster, edges shall be chamfered.

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

3.0 FANS:

3.1 GENERAL:

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

3.2 PROPELLER FANS:

Shall be supplied of the quality indicated on the drawings. Propeller fans shall operate on 220V/1 phase/50 Hertz A.C. current. Fans shall be directly mounted on the motor, and shall operate without disturbing noise, during normal operation. The discharge side of the fan shall be provided with self-closing shutters. Propeller fans shall be as manufactured by National Japan or approved equal local brand.

3.3 CENTRIFUGAL FANS:

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

3.4 AXIAL FANS:

Each fan shall be supplied with a suitably rated contactor/ starter/ isolator of approved pattern.

Fan casings shall be constructed of mild steel plates with angle stiffeners, with the casing hot dip galvanized after manufacture. The inlets and outlets of the axial flow fans shall be flanged for connection to the system. A drain plug shall be fitted and the casing designed to permit removal of the impeller.

An access door is to be provided on the casings of all fans. Casings shall cover both impeller and motor so that fans can be removed without disturbing adjacent ductwork or other components of the system. A flameproof external terminal box shall be fitted on the casing.

All lubrication points are to be extended to the outside of the casing and in a position that will permit access in relation to the adjacent plant, services or building structure.

Impellers shall be die cast in Aluminum alloy and X-rayed during manufacture. The impellers shall be capable of running continuously at 20% in excess of the rated speed. The impeller shall be keyed and locked onto the shaft, which shall be statically and dynamically balanced and tested at over speed before dispatch from the Manufacturer's works.

Flexible connections shall be supplied and installed at both inlet and outlet of each fan.
The fan bearings shall be of the sleeve type wherever possible. The bearings are to be truly aligned and rigidly mounted on to the casing.

Blade angle shall be adjustable over at least a 30-degree range, with markings at the root to indicate the blade angle.

Axial flow fans are to be driven by electric motors of commercially silent pattern carrying a Makers guarantee in this respect. The motors shall be totally enclosed, fan cooled.

All motors are to be positioned to permit effective ventilation of the motor and all component parts of the fan and motor are to be suitable to withstand the temperature conditions expected in the fan.

Electrical connections to the motors shall be in a totally enclosed terminal box secured to the exterior of the casing. Wiring within the axial flow fans shall be suitable for the conditions within the casings.

A suitable steel support is to be provided for each fan, and the frame is to be fabricated from rolled steel channel with adequate cross members for bolting the fan into position. The frame shall be of welded construction with anti-vibration mountings.

The anti-vibration mountings are to be rubber in shear pattern and of a type that are bolted to both the fan and the support.

All fans should be provided with lifting eyes, speed control, non- return dampen and wire guards.

3.5 INSTALLATION:

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

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

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

4.0 SHEET METAL DUCTWORK AND ACCESSORIES:

4.1 SHEET METAL:

Sheet metal ductwork shall be constructed of galvanized sheet steel conforming to ASTM A653 and zinc coating shall conform to G90. Sheet Metal shall be shall be provided per List of Approved Manufacturer's.

Galvanized sheet metal shall be lock forming quality (LFQ) and duct fabrication should be as per SMACNA standard or DW-144.

Galvanized sheet steel shall be confirming to BS2989 or ASTM A653A, 653M, G90 (Z275).

Rectangular Ducting shall be fabricated according to the following dimensions:

LARGEST NOMINAL DIMENSIONS OF DUCTING MM (INCHES)		U.S.S. GAUGE.		THICKNESS MM
Up to 675 (27'')	....	24	....	0.70
700-1275 (28"-51")	....	22	....	0.85
1300-2025 (52"-81")	....	20	....	1.00
Above 2025 (81")	....	18	....	1.31
Flue Duct	....	12	....	2.50

4.2 SPLITTER DAMPER:

Shall be fabricated of sheet metal, two gauges heavier than the duct gauge in which the damper is installed. Damper shall be fabricated of wood of an aero foil shape; over which sheet metal shall be formed to completely cover the wood. Damper shall be operated by a 3/8 inch (10 mm) dia rod brought through the side of the duct with brass locking set screw and bushing. Two operators shall be required on splitters over 200 mm (8 inches) wide. For insulated ducts, bushing shall be of thickness equal to the thickness of the duct insulation. Locking set screw shall be ¼ inch ¿, arranged for easy locking of the damper operator at the desired position. Damper shall be installed with full-length hinge. Rubber gaskets shall be installed to minimize air leakage. Damper operator shall be galvanized and shall be designed for convenience of operation.

4.3 QUADRANT VOLUME DAMPER:

Shall be multi-leaf opposed blade type, with a maximum blade width of 200 mm (8 inches). Dampers shall be constructed of sheet metal two gauges heavier than the duct gauge. They shall be operated by quadrant operators manufactured of brass. Operators shall be provided with standoff mountings on thermally insulated ducts to provide clearance between the ducts surface and operator, equal to the thickness of the insulation. Quadrant operator shall be heavy duty, capable of being locked at desired position conveniently. Damper after fabrication shall be provided with baked enamel finish.

4.4 AIR DEFLECTORS:

Shall be provided in all square elbows, duct mounted supply outlets, take-off or extension collars to supply outlets and tap-in-branch take-off connections. Air deflectors will be factory-fabricated units consisting of curved turning vanes or louver blades for uniform air distribution and change of direction with minimum turbulence and pressure loss. Square elbows shall be provided with curved vanes.

4.5 FIRE DOORS AND FIRE DAMPERS:

Shall be provided on all supply/Return duct crossing AHU rooms. Fire doors and fire dampers shall be fusible link curtain type approved for the protection of openings in one, two and four-hour fire rated walls and partitions and shall be installed in accordance with the Consultant's directives. Suitable hand- hole openings with tightly fitted access covers or doors shall be provided in the ducts to make all fire doors and fire dampers accessible for inspection and maintenance. Unless otherwise shown, the installation details given in NFPA 91 for fire doors and SMACNA Fire Damper Guide for fire dampers shall be followed except minimum thickness metal for all sleeves provided for the fire dampers shall not be lighter than 14 gauge. All necessary items associated with the fire doors and fire dampers such as retaining angles, sleeves, break-way connections and access doors shall be provided.
Fire dampers shall meet all UL and NFPA Standards and criteria for primary fire dampers in walls and floors with fire resistance rating of 4 hours and less.

4.6 DUCT ACCESS DOORS:

Hinged doors shall be provided at all automatic dampers, fire dampers, coils, thermostats, plenums, filters and other apparatus requiring services and inspection in the duct system. Doors shall be of 450 x 450 mm (18" x 18") unless otherwise required. Where size of duct will not accommodate this size, the doors shall be done as large as practical. Doors shall be rigid and provided with airtight felt gaskets. Doors shall be provided with galvanized hinges with bronze pins and two approved brass fasteners. Doors 600 x 600 mm (24" x 24") or larger shall be provided with fasteners operable from both sides. Doors in insulated ducts shall be of the insulated type. Unless otherwise

indicated, doors shall also swing those fan pressure or suction holds the door closed.

4.7 DUCT TEST HOLES:

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

4.8 FLEXIBLE DUCT WORK:

Flexible duct shall be lightweight aluminum laminated duct suitable for low and medium pressure system. The aluminum laminated construction shall encapsulate a high tensile steel wire helix between two layers of 0.9 micron thick plus 12-micron thick polyester. Flexible ducts shall be with factory applied thermal insulation and vapor barrier. Insulation shall be 25mm thick 16 kg / m^3 density.

4.9 BACKDRAFT DAMPER:

Backdraft dampers shall be low leakage with parallel blades and neoprene edge seals.

Dampers frames shall be constructed from galvanized sheet steel with Aluminum blades. Blade stub shafts shall be brass with PVC bearings. Sealing strips on blades shall be polyester foam.

Pressure relief dampers shall be multi-parallel blade with weighted arm closing assist. The frame shall be anodized Aluminum channel sections with formed Aluminum blades. Maximum blade length shall be 100 mm, and polyester foam seating strips shall be incorporated on blade edges. Bearings shall be in PVC with non-corrodible shafts.

4.10 INSTALLATION:

4.10.1 General: Sheet metal ductwork shall be constructed have galvanized sheet steel conforming to ASTM A-366-B2T. Unless otherwise approved ducts shall conform accurately to the dimensions indicated and shall be straight and smooth on the inside, with joints neatly finished. Ducts shall be secured to the structural slab in the building, and the method of anchoring and/or fastening is as detailed on the drawings. Ducts shall be constructed and installed so as to be completely free from vibrations under all conditions of operation. Layout drawings required under the clause APPROVAL OF MATERIALS AND EQUIPMENT shall show, for suspended ductwork, the location of all supports typical details for anchorage and details for special anchorage.

4.10.2 Duct Construction:

(a). Curved elbows shall have a centerline radius not less than 1.5 times the width or diameter of the duct.

(b). Joints for low velocity ducts shall be made substantially airtight, and no duct marks from air leaks shall show at duct joints, or connections to grills, registers and diffusers.

(c). Laps at the joints for low velocity systems shall be made in the direction of airflow. Button punch or bolt connections in standing seams shall be spaced at fixed centers not greater than 150 mm (6"). Horizontal locks or seams of the type known as Button Punch Snap Lock, may be used in lieu of Pittsburg Lock on low velocity systems.

(d). Transformations shall be made with sides pitched not to exceed a maximum of 20^{o}, 40^{o} included angle, for diverging air flow, and 30^{o}, 60^{o} included angle, for converging air flow, or as indicated on the drawings.

(e). Square elbows, fittings and branch take-off for low velocity shall be designed, constructed and installed as per recommendations in SMACNA Publications, "Low Velocity Duct Construction Standards".

(f). Splitter dampers, Quadrant Volume Dampers, Air deflectors, fire doors and fire dampers, duct access doors and duct test holes shall be installed where shown on the drawings and where required for the proper operation of the system even though not shown on the drawings.

Other details for duct construction: Casing construction, access doors, hangers and supports, duct joints, volume dampers, penetration of casing, casing curb detail, and hood construction shall be as indicated on the drawings or as indicated by the Consultant. Ducts shall be connected to intake and exhaust louvers, rain-hoods or goosenecks. Details of connections shall be as indicated, or directed by the Consultant. All connections of ducting to air handling units, dampers, plenums, rotary heat exchangers, etc. shall be through removable flanges. Installation of items not shown in detail or not covered by detailed specification shall be as set forth in the SMACNA Publications "Low Velocity Duct Construction Standards".

Bracing and jointing shall be done as per following table:

Ducting Dimensions – Inches	Size of Bracing Angle	Duct joint (Low Pressure)	Duct joint (medium Pressure)
Up to 23" larger dimensions	None	Hemmed " S" Slip bar	1 ½ "standing seam, 1 3/8 "welded flange, 1 1/8" Pocket lock.
24" – 30" larger dimensions	Joints at 4 ft. center without bracing or joints at 8 ft. center with 1" x 1/8" bracing between joint.	Hemmed " S" Slip bar 10 ' centers	1 ½ " standing seam, 1 ½ "Pocket lock.
31" – 42" larger dimensions	1" x 1" x 1/8" – 4 ft. Centre	Reinforced 1" x 1/8" bar slip 10' centers	2 " standing seam, 2" Flanged Joint.
43" – 72" larger dimensions	1.5" x 1.5" x 1/8" – 4 ft. Centre	Reinforced 1 1/2" x 1/8" bar slip 4' centers	2 "standing seam, 1.5"Flanged Joint with tie rod In center.
73" – 84" larger dimensions	1.5" x 1.5" x 1/8" – 4 ft. Centre	Reinforced 1 1/2" x 1/8" bar slip 4' centers	2 "standing seam, 1.5"Flanged Joint with tie rod In center.
85" – 96" larger dimensions	1.5" x 1.5" x 3/16" – 4 ft. Centre	Companion Angles 1 ½" x 1 ½ " x 1/8 " at 4' centers	2 "standing seam, 1.5"Flanged Joint with tie rod In center.

4.10.3 Duct Hangers: Duct hangers shall be installed as per the table given below:

Larger Duct **Dimension**	Angle Size	Maximum **Spacing**	Hanger Rod Size
Up to 30"	1" x 1" x 1/8" 1"	10' – 0"	Dia. 3/8"
31" – 60"	x 1" x 1/8"	10' – 0"	Dia. 3/8"
61" – 84"	11/2" x 11/2" x 1/8"	8' – 0"	Dia. 3/8"
85" – 96"	2" x 2" x 3/16"	8' – 0"	Dia. 3/8"
Over 97"	2" x 2" x 1/4"	6' – 0"	Dia. 1/2"

The above table shows the maximum spacing of hangers. Hangers shall however be installed at every change of direction, at volume control damper, at other duct mounted accessories location and where necessary to support the duct suitably.

4.10.4 Flexible Duct Connections (Expansion Joint):

Flexible duct connections as specified elsewhere shall be fitted wherever ducts cross building expansion joints, at suction and discharge end of Air Handling Units and Fans where ducts are connected to such unit, and or wherever shown on the drawings. Flexible duct connection shall be high grade woven fire-resisting cloth of minimum 250 lbs. tensile strength and 100 lbs. tear strength.

Details of flexible connections and bases shall be submitted to the engineer for approval.

5.0 DIFFUSERS, REGISTERS AND GRILLES:

5.1 GENERAL:

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

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

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

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

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

5.2 TERMINAL FILTER UNIT:

Terminal filter unit are laminar air flow diffusers with HEPA filter, that shall be fabricated as a fully assembled single unit. All stainless steel construction including casing/housing, grille, fasteners, damper, clamping mechanism for HEPA filter, etc. There will be no leak path between the filter inlet and air leaving side. Unit shall be designed for ease of filter removal from room side with common tool. Unit shall have pressure measuring points for the monitoring of the differential operating pressure. Unit shall be provided

complete with Hepa filter having 99.99% DOP on 0.3 micrometer particle, 1.0-inch w.g initial pressure drop and 2.5-inch w.g final pressure drop.

5.3 REGISTERS:

Shall be four-way directional-control type except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply registers face.

Registers shall be provided with sponge rubber gaskets between flanges and walls or ceilings. Wall supply registers shall be installed at least 150 mm (6") below the ceiling unless otherwise indicated. Type of registers shall be as indicated on the drawings or approved.

5.4 RETURN GRILLES:

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

5.5 LOUVERS:

Louvres shall be extruded aluminum frame with aluminum blades of not less than 2 mm thickness, and shall be firmly fixed so as not to vibrate.

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

5.6 INSTALLATION:

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

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

Registers and grills on sidewalls shall be fixed on deodar wooden frames. Frame thickness shall be 3 mm (1/8") less than the register/grill collar and shall cover the full width of the wall. Perfect alignment and symmetry shall be maintained.

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

6.0 THERMAL INSULATION:

6.1 GENERAL:

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

6.2 REFRIGERANT AND CONDENSATE DRAIN PIPING INSULATION:

(a) Copper Pipes: shall be insulated with 1-1/4" (32 mm) thick closed cells synthetic elastomeric foam insulation and wrapped with self-adhesive waterproofing tape and provide G.I cladding and where expose to atmosphere.

(b) Condensate Drains: shall be insulated with 3/8" (10mm) thick closed cell synthetic elastomeric foam insulation such as Aeroflex or Insulflex.

6.3 DUCT INSULATION:

(a) Duct Insulation: All indoor supply, fresh, exhaust & return air ducting shall be insulated with 50-mm thick, 1.5 lb/cu.ft. (24 Kg/m^3) density fiberglass insulation with aluminum foil reinforced with fiberglass yarn scrim and laminated to chemically treated fire resistant Kraft. All exposed exhaust air duct shall be insulated with 40mm thick 3.0 lb /cu. Ft (48 kg/m3) density. The insulation shall be applied to the duct surface with MOWLITH adhesive by CLARIANT. All joints shall be sealed with self-adhesive aluminum foil faced tapes 50mm wide.

Insulation shall be continuous and no gaps, crevices and other discontinuities shall be acceptable. All gaps shall cover 100% surface area of the duct and insulation and joint shall be overlapped 50mm.

(b) Jacketing: The complete insulation shall be provided with 0.5 Lbs./sq. (0.27 Kg/m^2) water proof canvas. The canvas shall be stretched tight over the insulation-using anti-fungus (Foster) adhesive, which shall cover 50% area and the edges sewer with nylon thread. Cut edges shall not be visible. All Longitudinal joints shall be on top for horizontal ducts and hidden from view for vertical ducts. Circumferential joints shall be equally distant and equal to the width of the canvas roll. Patches shall not be permitted.

All supply, return, exhaust and fresh air ducting where exposed to atmosphere shall be cladded with 26 gauge G.I. sheet metal after proper insulation.
The cladding shall be painted with one coat of primer and two coats of finish paint.

6.4 INSULATION SCHEDULE

S.No	SERVICE	THICKNESS mm	DENSITY Kg/m³	THERMAL CONDUCTIVITY w/m. °C	MATERIAL	PROTECTION	CLADDING
1	Duct - Supply, Return, Exhaust and Fresh air - air conditioned space/ air conditioned ceiling cavity.	50	24	0.032 @ 24 ° C	Fiber glass insulation with factory applied glass reinforced aluminum foil.	Canvas Cloth	26 Gauge G.I sheet and where expose to atmosphere
	Duct - Supply, Return, Exhaust and Fresh air duct - non air conditioned space.	50	48				
2	Copper Tubes	12	50	0.04 @ 24 ° C	Closed cell synthetic elastomeric foam insulation	Self - adhesive waterproo fing tape	26 Gauge G.I sheet where expose to atmosphere
3	Condensate Drain Pipe	10	70	0.04 @ 24 ° C	Closed cell synthetic elastomeric foam insulation	Self - adhesive waterproo fing tape	-

6.5 INSTALLATION:

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

(a) Vapor barrier shall be fixed to the insulation with a good quality, fibre resistant adhesive, approved by the Consultant. All circumferential

and longitudinal joints shall be lapped at least 1.5 inches. Vapour barrier shall be completely continuous. All scratches, tears, etc. shall be made good by pasting fresh layers of Kraft paper on the discontinuity. Adhesive shall cover at least 75% of the insulation area.

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

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

6.5.3 Cladding: All insulated pipes where expose to atmosphere shall be provided with a cladding of 26 gauge G.I. sheet metal. The cladding shall be painted with one coat of primer and two coats of finish paint.

7.0 ELECTRICAL WORKS:

7.1 GENERAL:

The Contractor shall be responsible for the complete power and control electric wiring of AHU room and other areas as required for air conditioning system. A 3 phase and neutral, 4 wire Electric Supply with earthing continuity conductors where indicated on the drawings will be available for the Contractor. Wiring onwards from this supply point to all motors, controls, etc., shall be the responsibility of the Contractor.

For remotely located equipment, a power point shall be supplied near each unit, or where indicated on the drawings and wiring onwards shall be the responsibility of the air-conditioning contractor.

The electrification work shall be carried out by a licensed workman, authorized to undertake such a work under the provision of Pakistan Electricity Act and Rules and the latest edition of I.E.E. Wiring Regulations.

Any special requirements of the local Electric Supply Company shall be complied with.

7.2 CABLES:

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

7.3 ELECTRIC MOTORS:

The electric motors shall be of the type and sizes required for driving all air-conditioning equipment and should comply with the rules of Electrical Machines as stated in the VDE0530 and the BS 2613: 1957 specifications. The motors offered should have output rating as specified and should meet the system requirements.

Adjustments on motor horsepower or speed will be allowed on this account. Generally, all motors shall be constant speed, three phase squirrel cage induction type, unless otherwise specifically noted.

The motors offered should be designed and rated for 400V, 3 phase, 50 cycles A.C. system and should be able to give their rated output at + 5% the rated voltage and frequency.

The motors shall be suitable and be able to give required output under site conditions i.e. maximum ambient temperature of 120°F and altitude 1000 meters.

The motor where specified as of single phase should be suitable for operation on 220 + 5% volts, 50 cycles A.C. system.

The motor shall be tropicalized class 'F' insulation and fungus proof. Unless otherwise specified the motors shall have drip proof construction for indoor installation and totally enclosed weatherproof; fan cooled construction for outdoor installation.

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

7.4 CABLE TRAYS:

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

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

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

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

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

g. Flanges shall be a minimum of 50 mm deep.
h. Minimum radius at side rails, horizontal and vertical tees and crosses shall be in accordance with the Manufacturer's standard.

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

7.5 STEEL CONDUIT AND ACCESSORIES:

All conduits shall be of heavy gauge 16 SWG steel, manufactured and tested in accordance with latest relevant standards.

The conduit shall be protected by two base coats of red oxide anti-rust paint and finished in first quality black enamel paint. The coating shall be of heavy enamel, which shall not flake or crack during installation and handling. Each conduit length shall be furnished with threaded ends and a threaded coupling at one end. Soft metal bushes shall be provided at conduit termination to prevent damage to cable during pulling operation.

Junction boxes shall be 100 mm square, having minimum depths of 38 mm or 65 mm as required for accommodating the number of wires. The junction box shall be 16 SWG sheet steel provided with anti-rust paint and finished in heavy black enamel paint. The cast Iron outlet boxes for light points shall be round having 50 mm diameter and 63 mm depth. The above dimensions are given as minimum only, and the exact size shall be determined by the Contractor keeping in view the ease of Installation and maintenance. All outlet boxes and junction boxes shall be provided with one piece Bakelite cover plate of suitable design.

7.6 GALVANIZED IRON PIPES AND ACCESSORIES:

The G.I. pipes shall be galvanized from inside and outside by hot dip galvanizing method. The pipes shall be free from stains, burrs or any other defect. The accessories for G.I. pipes shall be galvanized from inside and outside. The conduit shall be NPT threaded, with at least 5 complete threads and assembled with TEFLON tape.

7.7 INSTALLATION:

7.7.1 General: The Contractor shall be responsible for the complete power and control electric wiring of the air-conditioning system. A 3 phase and neutral, 4 wire Electric Supply with earthing continuity conductors where indicated on the drawings will be available for the Contractor. Wiring onwards from this supply point to all motors, controls, etc., shall be the responsibility of the Contractor. Power point shall be provided near exhaust fans.

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

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

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

7.7.3 Steel and G.I Conduit

The minimum size of conduit shall be 20 mm.

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

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

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

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

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

Repair painting shall take place before any making good on site or buildings is carried out. The entire conduit system shall be checked for continuity. Any observation found shall be removed without damaging the installation.

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

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

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

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

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

7.7.4 Testing:

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

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

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

Circuits up to 250 volts:	500 volts D.C.
Circuits above 250 volts and up to 500 volts:	1000 volts D.C.

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

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

(c) Operational Tests:

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

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

8.0 AUTOMATIC CONTROL SYSTEM:

8.1 GENERAL:

The Contractor shall supply, install and connect with existing control system a fully Integrated Control System incorporating Direct Digital Controls (DDC) for Monitoring and Control and shall consist of the following elements:

1. Microprocessor based standalone controllers, interfacing directly with sensors, actuators, differential pressure switch etc.

2. An industry standard protocol communication network (RS-485) to allow data exchange and inter-communication between standalone controllers & the Central Operator Workstation. 3rd party interface shall be based on BACNet Protocol.

3. A personal computer (PC) based central operator workstation and licensed software functioning as the primary operator for the control system.

4. Electrical and Electronic Controls for all items indicated on drawings and described hereinafter including dampers, actuators, valves and panels etc.

5. All system components shall be fault tolerant.

   – It shall provide satisfactory operation without damage at 110% and 85% of rated voltage and at +3 Hz variation of line frequency.

   – It shall provide static, transient and short circuit protection on all inputs and outputs. Communication lines shall be protected against incorrect wiring, static transients and induced magnetic interference. Bus connected devices shall be A.c. coupled or equivalent so that any single device failure shall not disrupt or halt bus communication.

6. All real time clocks and data file RAM shall be battery or capacitor backed.

7. It is Contractor responsibility to provide interface for all systems as per drawings including interfacing card and software. Contractor is responsible to provide fully functional Automatic Control System without any fault. No variation or claim shall be entertained in this regard.

8. The I/O summary and quantities given in the drawings are indicative and for guidance only. The Contractor shall calculate actual points and quantities for all systems and shall submit the same for Engineer's review and approval. Required points and quantities shall be provided without any additional cost.

8.2 AUTOMATIC CONTROLS CENTRAL - HARDWARE

8.2.1 General:
The control System shall be a PC Based concept allowing for the full integration of Direct Digital Control and Individual Zone Control to be controlled and monitored by one common system.

The Control System shall be an imported item and shall be supplied through authorized local agents as per make mentioned in List of Approved Manufacturers.

8.3 OPERATION STATION SOFTWARE:

Operator Station Software shall be **Licensed** and shall include as a minimum the Data Base Manager, Communication Control, Operator Interference (OI), Alarm Manager, Reports Manager, Dynamic Color Graphic display of equipment / Plant room etc., Trending, Time Scheduling & Equipment Runtime Tantalization. Furthermore, minimum 3 Client Licensed software are also required for remote locations.

1. Real Time Operating System shall provide true multi-tasking, providing concurrent execution of multiple real time programs and custom program development.

2. The Operating System shall be Licensed MICROSOFT WINDOWS.

3. Data Base Manager shall manage all data on an integrated and non-redundant basis. It shall allow additions and deletions to the database without any detriment to the existing data. Cross linkages will be provided such that no data required by a software program can be deleted by the operator until that data has been deleted from its respective program.

4. Communications control, scheduler, trend files, reports, operator interface, and utilities shall be as specified hereinafter.

8.3.1 Operator interface Software: Provided a hierarchical linked dynamic graphic operator interface for accessing and displaying system data and commanding and modifying equipment operation. The interface shall utilize the mouse to provide "heads up operation: with pull down menus, dialogue boxes, zoom, coloration, animation and split screen to facilitate operator understanding of the system.

A minimum of twenty (20) levels of graphic penetration capability shall be provided with the hierarchy operator assignable (for example: area, building, wing, floor, and air handler, point group). Descriptions for graphics, points, alarms, etc. shall be modified through the operator station under password control.

1. Operator access to the System shall be under personal ID and password control. Up to 8 alphanumeric characters for password shall be assignable to each operator. The operator shall be able to access the system from the operator station in the system by entry of the proper ID and password. The operators shall be permitted to change their own password without permitting access to any other password.

2. Data to be displayed within a unique graphic shall be assignable regardless of physical hardware address, communication channel or point type (temperature, humidity, alarms, etc.). Graphics shall be on-line programmable and under ID and password control. Points may be assignable to multiple graphics (10 minimums where to facilitate operator understanding of system operation.

   Graphics shall also contain calculated or pseudo points. Each physical point and each point assigned to a graphic shall be assigned a text descriptor for use in reports.

3. Data segregation shall be provided for control of specific data routed to an operator station, to an operator assigned to a station or to a given output device such as a printer. Point types shall be randomly selectable such as all room temperature points, room temperature points second floor, all duct temperature points, HVAC points, command points, etc.

4. All operator-accessed data shall be displayed on the color monitor. The operator shall be select further penetration via mouse click on an area, building, floor, fan, etc. The defined linked graphic below shows that selection shall then be displayed. Dynamic data shall be assignable to any and all graphics.

   The operator shall be provided with a means to directly access any graphic without going through the penetration path.

5. The operator shall be provided with a means to directly access any graphic or any point without going through the penetration path.

   (a) Direct access to graphics shall be menu selectable wherein the operator may optionally enter the name of the graphic system desired or select the desired graphic via cursor positioning on a scroll bar listing of all graphics, or may be selected via keyboard entry.
   (b) Operators may assign simple key names for points to allow direct display or commanding of points. Key name assignments shall be fully operator assignable and as simple as one, two or three characters or as lengthy as 20 characters, such that frequently selected point may be accessed independent of complex penetration schemes. For example, a fan serving the South quadrant lobby of the Academic Block may be assigned

a key name as simple as "HF1". The key name processor shall also allow the selection of graphics associated to points by entering the key name and a graphic appendage, such as "HF1 G", and shall allow the direct execution of a command by entering the key name and a command appendage, such as "HF1 ON".

6. Points (physical and pseudo) shall be displayed with dynamic data provided by the system with appropriate text descriptors, status or value and engineering unit. Coloration conventions shall be variable for each class of points, as chosen by the owner. In addition, animation shall be used to confirm latest commands (e.g., fan rotation, damper position, fluid flow, etc.). All points shall be dynamic with update rates user adjustable on a per point basis.

7. For operators with the appropriate privilege(s), points shall be commanded directly from the color monitor via mouse selection. For a digital command point such as valve position, the valve would show it current state (e.g., CLOSED) and the operator could select OPEN via mouse click. For most operations, a keyboard equivalent shall be available for those operators with that preference.

   Upon selection of analog command-able points (such as discharge air static pressure), a dialogue box shall appear containing the following:

   – The value of selected point as a decimal value and as represented on a scaled bar chart element.

   – A scaled set point arrow pointed to the current position of the set points value on the bar chart.
   – The decimal value of the set point with adjacent up-down arrows.

   The Operator shall be afforded three months of analog commanding from which to choose as follows:

   – Click the cursor on the decimal set point value, and enter a new set point value via the keyboard decimal keypad.

   – Drive the decimal value up or down by moving the cursor to the desired position and clicking.

   The bar chart shall also have associated arrows showing the current position (scaled value) of the alarm limits.
8. An operator shall be permitted to split or realize the viewing screen to show one graphic on the left half of the screen and another graphic, spreadsheet, bar chart, word processing, curve plot, etc., on the right half screen.

This shall allow real time monitoring of one part of the system while displaying other parts of the system or data from the system to facilitate system operation.

9. An on-line context-sensitive help utility shall be provided to facilitate operator training and understanding. The help feature shall be a hypertext document with the ability to bridge to further explanation of selected keywords. The document shall contain text and graphics to clarify system operation. At a minimum, help shall be available for every menu item and dialog box.

8.3.2 Site Specific Customizing Software:

1. Provide software, which will allow the user to modify, and tailor the control system to the specific and unique requirements of equipment, installed, the programs implemented, and to staffing and operational practices. Online modification of system configuration, program parameters, and database shall be provided via menu selection and keyboard entry of data into preformatted self-prompting templates. As a minimum, the following modification capabilities shall be provided:
   (a) Operator assignment capability shall include designation of operator passwords, privilege(s), starting graphic and auto sign off duration.

   (b) System text add/change capability shall include English descriptors for graphic points, action message for alarm and runtime, and trouble condition messages.
   (c) Time/Schedule change capability shall include time/date set, time/occupancy schedules, holiday schedules, daylight saving time schedules and activity defined schedules. Operators with the appropriate privileges shall be capable of naming an activity (e.g., basketball game, board meeting, etc.) which requires associated equipment (e.g. fans, lights, door unlocking, etc.), to support the activity. The named activity shall be assigned such associations and, subsequently, an operator can schedule the activity with the underlying associated equipment automatically provided an identical schedule by the BMS. All time and calendar scheduling and schedule modification shall be accomplished graphically via color bars and calendars in a hardware independent manner.

   (d) Points shall be uniquely definable as to coloration, animation, audible rate and duration, point descriptors (60 characters minimum), operator message (480 characters minimum) alarm and warning limits, and engineering units.

   (e) Point related change capability shall include system/point enable/disable; run time enable/disable; assignment of points

to point classes, analog value offset, lockout, run time limits, and setting a fixes input or output valve.

(f) Application program change capability shall include assignment of comfort limits, global points, time and event initiators, and time and event schedules and enable/disable time and event programs.

(g) Graphic creation specified under Graphic Creation.

8.4 ALARM HANDLER:

Alarm Handler software shall be provided to respond to alarm conditions sensed and transmitted from the appropriate Controller. First in, first out handling of alarms in accordance is required with buffer storage for a minimum of 20 alarms in case of simultaneous multiple alarms.

Alarm handler shall be active in both the Signed Off modes to assure that alarms will be processed even through an operator is not currently signed on:

1. Alarm shall be displayed in a dialogue box on the color monitor. Display shall include as a minimum:

   (a) Indication of alarm condition; i.e. FAULT, PRE-ALARM, ALARM, and analog identification such as HIGH ROOM TEMPERATURE, GROUND FLOOR.

   (b) A discrete per point action taking message.

2. Alarm silencing shall be by selecting the "silence" button or by authorized operator's acknowledgement. In all cases, operators authorized to acknowledge a point in alarm should only allow alarm acknowledgement.

3. Each point shall be assigned to an alarm class, with no limit to the quantity of alarm class. Each alarm class shall be uniquely assignable to any combination of the following alarm processing attributes:

   - Audible beep duration (none, 10 seconds, 20 seconds, continuous)
   - Audible beep rate (slow-medium-fast)
   - Alarm historically archived (yes or no)
   - Alarm printed, with printer ID
   - Associated coloration with any of 256 colors, with separate brightness control, assignable to each alarm state (high alarm, high warning, low alarm). Digital points shall similarly be distinguished with different colors for each possible state.

8.5 REPORTS:

Standard reports shall be provided which shall be operator selectable to appear on the operator station, or printer or both. All facility-wide standard reports shall be capable for being scheduled to run at a specific time and /or interval via an operator function supported by necessary data entry templates and interactive prompts.

A "terminate report" command shall be available to allow the operator to stop any report in the process of being printed. Standard pre-formatted reports to be provided shall include:

1. Point summary report may be requested at any penetration level (facility, building, area, and system) and shall include only points at and below that level. Point summary reports shall include the current value/status and condition, system and point descriptors for all points, only those points in alarm, fixed points disable points and locked out points.

2. Historical trend reports shall allow the operator to randomly select points to be recorded at selectable time intervals. Information shall be automatically diverted into a standard third party software spreadsheet package for display, manipulation and merging as necessary by the authorized operator. Minimum sample shall be at 10 minutes for logging values of 40 variables over a period of one month.

   The trend report shall be stored to disk and shall be subsequently capable of being displayed, printed or archived to diskette by the operator.

3. A custom report capability shall be provided to allow the user to format reports of any text, points with status/value and descriptors, and points with status/value only. Custom reports may be scheduled or requested manually. A spreadsheet program (Microsoft Excel) shall be provided fully integrated with BMS database, and available to the user.

8.6 GRAPHIC CREATION:

A graphic development facility shall be provided to allow the user to develop or modify graphic displays and assign and position any array of points within each graphic.

1. All graphic display shall be created via operator station graphics package. It shall not require taking the operator station offline or interfere with point archiving and alarms. Graphics shall be created via mouse and keyboard selection of graphic library stored symbols and system profiles. In addition, the system shall have the capability to create custom symbols, system profiles, floor plans, buildings, etc., and store them in the graphic library.

2. The number and type of graphics to be provided is as noted in the Data Control and graphics summary.

8.7 DIGITAL SYSTEM MANAGEMENT:

The Operating Station shall provide complete utilities necessary for management of the network of digital controllers and devices:

1. Provide a multi-page set of graphic architectural displays showing each digital module including each remote panel, PC, peripheral, and communication links. Clicking on any device shall start an interactive dialogue allowing the user to observe the device status and to select device management options. Each device shall also be provided with a descriptor of up to 60 characters.

2. Any digital device with database storage in RAM only may be up-line of down-line loaded to or from the operator Station disk for backup archival.

3. Provide Software to execute and observe diagnostics of any remote device connected to the bus and the ability to deactivate and restart the device.

8.8 OPERATOR STATION UTILITIES:

The Operator Station Personal Computer shall be provided with the following system utilities or desktop application packages:

Clock	–	Real time clock
Calculator	–	Basic arithmetic calculation functions (add, subtract, multiply, divide, percent, square root)
Clipboard	–	Data transfer facility between dis-similar programs
Calendar	–	Electronic appointment calendar
Card file	–	Electronic index card file
Control Panel	–	Basic PC operating characteristic control: cursor blink rate, mouse sensitivity, screen color control, etc.
Write	–	Word processing program

8.9 THIRD PARTY SOFTWARE:

The system provided shall be capable of running standard off-the–shelf MS DOS, WINDOWS IBM PC compatible software packages concurrently with the real time system. As standard the Central shall include MS OFFICE.

1. The base system software shall include CRT "windowing" features to allow the operator to monitor the real time system and used third party software simultaneously.

2. All third party software packages identified shall have access to the system historical database previously specified.

8.10 PROVIDED GRAPHICS:

In addition to Graphics of building system with dynamic points as noted in the following Data and Control and Graphics summary, and Graphics required under the Digital System management sections, the following additional graphics shall be quantified and included within the proposal:

External layout (showing buildings, streets, etc.).

Individual Floor plans or isometrics.
Any other graphics necessary for logical penetration.
Sequence of operation.

Flow-charts for critical DDC loops.

Supervisor graphics.

System configuration.

Other graphics required of felt necessary by Consultants.

8.11 REMOTE CONTROLLER – CONTROL AND MONITORING:

Use of pre-programmed application can be preferred and these shall employ minimum engineering and simplify site commissioning by using an interactive operator interface with local language.

CONTROLLER HARDWARE (DDC CONTROLLER):

All controllers furnished for the project shall be of the fully standalone intelligent type. In the event of loss communication with the Central, the controllers shall be fully operational. Master/Slave type of controllers shall not be acceptable.

All controllers shall be provided with one portable terminal with LCD (liquid crystal) display that can easily be connected to controller with phone jack type of connector. A touch panel keyboard shall be provided for display of all data and adjustment of parameters. Mode of operation of the LCD display and keyboard shall be password protected to restrict unauthorized use.

Features to be provided on the controller must include:

– Microprocessor Control.

- The microprocessor controller shall be site programmable, enable to incorporate any programming change if needed. Factory programmed controllers are not acceptable.

- Data collection, processing and Reporting

- Programs loaded into the Controller shall be saved in nonvolatile E^2PROM memory, so there is no need to reload software after a loss of power.

- Low Voltage Safety Power Supply.

- All controllers shall monitor and control, digital input, digital output, analog input and analog output points. A minimum of 10% spare capacity shall be provided at each controller.

- In addition, all controllers shall be furnished with both the additional capacity to provide a local common alarm output and an on board annunciator for the purpose of initiating an audible warning in the event of an alarm condition.

- All enclosures on roof shall be waterproof i.e. IP-65 / NEMA 4.

8.12 FIELD DEVICES:

General: Provide where indicated on the drawings of Input/output (I/O) Schedule, the microprocessor, electronic and /or electric system components and sensing device as required. The field device shall be interfaced directly with the BMS to provide a totally integrated control system.

Input/Output sensors and device shall be closely matched to the requirement of the DDC controllers for accurate responsive and noise-free signal INPUT/OUTPUT. Control input response shall be of high sensitivity and matched to the loop gain requirements for precise and responsive control. Field devices located on roof shall be weatherproof.

(a) Temperature Sensors: Temperature sensor for space, pipe and duct shall be of the resistance temperature detector (RTD) type of platinum/nickel 100, 1,000 ohms or with integral of 4-20mA or 0-10VDC converter with a temperature sensing accuracy of ± 1% or better. Other temperature sensors such as thermistor or integrated circuit (I/C) types, which have, lower accuracy and/or low signal/noise ratios shall not be acceptable.

Duct mounted temperature sensor shall be the rigid stem type and pipe mounted temperature sensors shall be provided with a separable copper or stainless steel well.

Mixed air temperature sensor shall be averaging type.

(b) Relative Humidity Sensors: Relative humidity sensors shall be of the capacitance type with an effective sensing range of 10% to 90% RH. Output signal shall be 4-20mA or 0- 10VDC. corresponding to 0% to 100% RH.

(c) Current Switches: Current switches shall be solid or split core type with adjustable set point to provide accurate fan and pump run/fail status by monitoring the current draw.

(d) Differential Pressure Switches: Differential pressure switches shall be provided with adjustable set point (1.4 to 10 mbar) to provide accurate monitoring of filter condition.

DPS with manual reset shall be used for Air Handler safety.

(e) Pressure Sensors: Pressure sensors for both air and water application shall be of the state-of-the-art piezo resistive type. The pressure-sensing diaphragm shall be of silicon material. All pressure sensors supplied shall have no moving parts and shall not require any maintenance or calibration.

Pressure sensor shall be selected for approximately 50% over range and have standard output signals, e.g. 4-20mA. Signals that are specific to a manufacturer's DDC controller's input range will be acceptable provided the sensor is of the same manufacturer as the DDC controller. All pressure sensors shall have temperature compensation built-in. Repeatability and hysteresis shall be ± 0.25% or better. Shock and vibration resistance capabilities shall comply with MIL-STD-202 or better. For protection against surges and stable reading, all water pressure sensors shall be installed together with a pressure snubber.

(e) Damper Actuators: All damper actuators shall be of electric/electronic type and shall be direct mounted to dampers. Rotation shall be adjustable from 30° to 90°. Manual override switch shall be provided for easy setup and air balancing.

(f) Fan Coil Thermostats: The room thermostat for the control shall have an attractive styling (touch screen) and shall be subject to the Architect's approval.

The thermostat-sensing element shall be of the dual diaphragm type for accurate and responsive sensing of temperature changes. The thermostat shall have a sensing range of 10 to 30°C and a nominal differential of 0.5°C.

The thermostat shall have a large schedule reset feature.

The thermostat shall be double insulated for electrical safety. No earth wire shall be required for operation.

(g) Smoke Detectors: All smoke detectors mounted at the AHU return duct shall be the duct mounted photoelectric type.

The detector shall sample the air passing through the AHU to provide early detection of a developing hazardous condition or fire. When smoke is detected by the detector at the return air duct, the AHU fan shall be shut down.

The detector head shall be housed in an integral housing with filter system for reduced maintenance and service. The detector head shall be accessible without removing the duct housing. The air velocity limits shall be 300 to 4000 ft./min.

For reliability and safety considerations, the smoke detector shall comply with UL, FM, CSFM and BSA standards.

8.12.1 System Wiring: The Contractor shall provide all necessary power, communication, control and data transmission cables, conduit and trunkings within the Building and as shown on the Drawings as to form complete installation. Data transmission cables between the BMS Room and the DDC Panels shall be installed within dedicated BMS Room and DDC panels shall be installed within dedicated BMS trunking provided by the Contractor.

All BMS Power, Communication and Control Cables shall be Fire Rated (at least for 03 hours), Low Smoke, Zero Halogen (LSZH) with Third Party verification (LPCB, BASEC).

– Central Communication Cable

Type of Conductor	…	Twisted Shielded
Number of Conductor	…	Three
Wire Gauge	…	18 AWG

– Power Supply Cable

Type of Conductor	…	Non-Twisted Non-Shielded
Number of Conductor	…	Two
Wire Gauge	…	14 AWG

– Input/Output Communication

Type of Conductor	…	Non-Twisted Non-Shielded
Number of Conductor	…	As Required
i) Digital In/Out	…	Two
ii) Analog In/Out	…	Two/Three

Wire Gauge

i) Digital In/Out	…	18 AWG
ii) Analog In/Out	…	18 AWG

8.13 WARRANTY:

All components, system software, parts and assembles supplied by the sole representative of manufacturer shall be guarantee against defects in materials and workmanship for one year from system commissioning or 18 months from shipment date, whichever is earlier.

Labor to troubleshoot, repair, reprogram, or replace system components shall be furnished by the Contractor at no charge to the Owner during the warranty period.

All corrective modifications made during warranty service periods shall be updated on all user documentation and on user and manufacture achieved software disks.

All software adjustment, during the warranty period shall be free of charge.

8.14 INSTALLATION:

The Contractor is responsible for complete installation and commissioning of Automatic Control System.

A factory Trained Engineer, duly Authorized by the Control Manufacturer shall Supervise the Commissioning of the Control System and give instructions at site to the Employer's Operating personnel for Operation of the System for a period of at least two weeks at job site.

9.0 PIPING AND FITTING:

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

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

9.1 REFRIGERANT VALVES AND SPECIALTIES

A. Diaphragm Packless Valves: 3450-kPa working pressure and 135 deg C working temperature, globe or angle pattern, forged-brass or bronze body and bonnet, phosphor bronze and stainless-steel diaphragms, rising stem and hand wheel, stainless-steel spring, nylon seat disc, with solder-end connections.

B. Packed-Angle Valves: 3450-kPa working pressure and 135 deg C working temperature. forged-brass or bronze body, forged-brass seal caps with copper gasket, back seating, rising stem and seat, molded stem packing, with solder-end connections.

C. Check Valves-Smaller than DN25: 3450-kPa operating pressure, 149 deg C operating temperature; cast-brass body, with removable piston, PTFE seat, and stainless-steel spring; straight-through globe design. Valve shall be straight-through pattern, with solder-end connections.

D. Check Valves-Larger than DN25: 3100 kPa operating pressure, 149 deg C operating temperature; cast-bronze body, with cast-bronze or forged-brass bolted bonnet; floating piston with mechanically retained PTFE seat disc. Valve shall be straight through or angle pattern, with solder-end and connections.

E. Service Valves: 3450-kPa pressure rating, forged-brass body with copper stubs, brass caps, removable valve core, integral ball check valve, with solder-end connections.

F. Solenoid Valves: Conform to ARI 760; 121 deg C temperature rating, 2760 kPa working pressure: forged brass, with PTFE valve seat, 2-way straight through pattern, and solder end connections; manual operator, with NEMA 250, Type I Solenoid enclosure with 13-mm conduit adapter, and 24-V normally closed holding coil.

G. Pressure Relief Valves: Straight or angle brass body and disc, neoprene seat, factory sealed and ASME labelled, for standard pressure setting.

H. Thermal Expansion Valves: Conform to ARI 750; thermostatic-adjustable, modulating type; size as required and factory set for superheat

requirements; solder end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.

I. Straight or Angle Type Strainers: 2960 kPa working pressure; forged brass or steel body with stainless steel wire or brass reinforced Monel screen, and screwed cleanout plug, with solder end connections.

J. Straight, Non Cleanable Type Strainers: 3450 kPa working pressure; steel shell with stainless steel screen, with solder end connections.

K. Moisture / Liquid Indicators: 3450 kPa operating pressure, 93 deg C operating temperature; forged brass body, with replaceable, polished, optical viewing window with color-coded moisture indicator, and solder end connections.

L. Replaceable-Core Filter-Dryers: 3450-kPa operating pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel cap screws, and wrought copper fittings for solder end connections; with replaceable core kit, including gaskets, as follows:

   a. Filter Cartridge: Pleated media with integral end rings, stainless steel support, ARI 730 rated for capacity.
   b. Filter-Dryer Cartridge: Pleated media with solid core sieve with activated alumina, ARI 730 rated for capacity.
   c. Wax Removal Cartridge: Pleated media with solid-core sieve with activated charcoal and desiccant with integral gaskets.

M. Permanent Filter-Dryer: 2140 kPa maximum operating pressure, 107 deg C maximum operating temperature; steel shell, and wrought copper fittings for solder end connections; molded felt core surrounded by desiccant.

N. Flexible Connectors: 3450 kPa operating pressure; seamless tin-bronze or stainless steel core, high tensile bronze braid covering, solder end connections and synthetic covering; dehydrated, pressure tested minimum 180mm long.

9.2 INSTALLATION

A. Install refrigerant piping according to ASHRAE 15.

B. Contractor shall verify refrigerant pipe sizes as per manufacturer's recommendations, pipe sizes mentioned in schematic drawings are tentative not the actual one.

C. Install piping in short and direct arrangement with minimum number of joints, elbows and fittings.

D. Arrange piping to allow normal inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.

E. Install piping with adequate clearance between pipe and adjacent wall and hangers, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

F. Insulate suction lines and liquid lines, but insulate them together if adjacent.
   a. Do not install insulation until system testing has been complete and all leaks have been eliminated.

G. Install branch lines to parallel compressors of equal length, and pipe and identically and symmetrically.

H. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanically injury.

I. Slope refrigerant piping as follows:
   a. Install horizontal hot-gas discharge piping with a uniform slope of 0.4 percent downward away from compressor.
   b. Install horizontal suction lines with a uniform slope of 0.4 percent downward to compressor.
   c. Install traps and double risers where indicated and when required to entrain oil in vertical runs.
   d. Liquid lines may be installed level.

J. Use fittings for changes in direction and branch connections.

K. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

L. Reduce pipe size using eccentric reducer fittings installed with level side down.

M. Install unions to allow removal of solenoid valves, pressure-regulating valves, expansion valves, and at connections to compressors and evaporators.

N. Install flexible connectors at the inlet and discharge connection, at right angles to axial movement of compressor, parallel to crankshaft.

O. Install replaceable-core filter-dryers, with isolation valves and valve bypass.

P. Install refrigerant valves according to manufacturer's written instructions.

Q. When brazing, remove solenoid-valve coils; remove sight glasses; and remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialities. Do not apply heat near bulb of expansion valve.

R. Mount thermostatic expansion valves in any position, close to evaporator.

a. Where refrigerant distributors are used, mount directly on expansion-valve outlet.
b. Install valve so diaphragm case is warmer than bulb.
c. Secure bulb to clean, straight, horizontal section of suction line using 2 bulb straps. Do not mount bulb in a trap or at the bottom of the line.
d. Where external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

S. Install pressure relief valves as required by ASHRAE 15.

T. Charge and purge systems, after testing, and dispose of refrigerant following ASHRAE 15 procedures.

U. Charge system as follows:
a. Install filter-dryer core after leak test, but before evacuation.
b. Evacuate refrigerant system with vacuum pump, until temperature of 1.7 deg C is indicated on vacuum for minimum of 5 hours.
c. Maintain vacuum for a minimum of 5 hours.
d. Break vacuum with refrigerant gas and charge of 14 kPa.

9.3 HANGERS AND SUPPORTS

A. General: Provide hangers, supports, and anchors according to ASME B31.5 and MSS SP-69.

B. Adjustable steel clevis hangers for individual horizontal runs less than 6 m or longer.

C. Roller hangers and spring for individual horizontal runs 6m or longer.

D. Pipe rollers for multiple horizontal runs, 6 m or longer supported by a trapeze.

E. Spring hangers to support vertical runs.

F. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes. Tube size are nominal or standard tube sizes are expressed in ASTM B 88M.
a) 15mm: Maximum span, 1500 mm, minimum rod size, 6.3 mm.
b) 18mm: Maximum span, 1500 mm, minimum rod size, 6.3 mm.
c) 28mm: Maximum span, 1500 mm, minimum rod size, 6.3 mm.
d) 35mm: Maximum span, 1800 mm, minimum rod size, 6.3 mm.
e) 42mm: Maximum span, 2400 mm, minimum rod size, 9.5 mm.
f) 54mm: Maximum span, 2400 mm, minimum rod size, 9.5 mm.
g) 67mm: Maximum span, 2700 mm, minimum rod size, 9.5 mm.

G. Support vertical runs at each floor.

10.0 CLEANING, TESTING, BALANCING AND TEST DATA:

10.1 GENERAL:

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

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

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

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

10.2 CLEANING AND ADJUSTING:

Pipe shall be cleaned free of scale and thoroughly flushed of all foreign matter. Equipment shall be wiped clean, with all traces of oil, dust or paint spots removed. Temporary filters shall be provided for all fans that are operated during construction, and after all construction dirt has been removed from the building, new filters will be installed.

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

10.3 TESTING:

b) Duct Work: Ducts, plenums and casings shall be tested and made substantially air tight at static pressure indicated for the system before covering with insulation or concealing in the masonry. The term substantially airtight shall be constructed to mean that no air leakage is noticeable through the senses of feeling or hearing.

10.4 BALANCING:

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

10.5 PERFORMANCE TESTS:

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

10.6 TEST DATA:

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

10.6.1 Air Balance:

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

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

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

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

10.7 CONTROL SETTING:

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

10.8 OTHER EQUIPMENT:

The contractor shall also provide written data on the performance of any other equipment; in the form and manner and giving all information required by the Consultant/Engineer. The Contractor shall also submit a certificate along with all test reports submitted, certifying that all tests have been carried

out by component engineers, and that all data submitted has been verified and found to be correct.

10.9 TEST PROCEDURES:

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

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

11.0 PAINTING AND FINISHING:

11.1 GENERAL:

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

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

Paint shall be applied to the following:

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

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

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

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

11.2 IDENTIFICATION TAGS:

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

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

11.3 DUCT WORK IDENTIFICATION:

1. After completion of insulation and /or painting, all ductwork exposed or concealed shall be marked in English to show the services name and direction of flow.

2. Marking shall be placed at each side of any wall, partition or floor, at 10m intervals on all exposed ductwork and at each access panel or door. Marking shall be located so as to be in full view.

3. Marking shall be stenciled. Use black stencil on light colored surfaces, yellow stencils on dark colored surface except where fire lines which shall be stenciled in accordance with civil defence requirements. Stencils shall have distinct edges. Blurred stencils are not acceptable. The name of the services shall be stenciled fully or with abbreviations standard to the industry. Non standard abbreviations are not acceptable. Letters shall be a minimum of 50mm high for ducts and for pipes 75mm or larger to outside of insulation. Letters for smaller pipes shall be 20mm high. All markings shall be clearly legible from 1.5m above the adjacent floor or platform.

12.0 OPERATING AND MAINTENANCE INSTRUCTIONS:

12.1 BOUND INSTRUCTIONS:

Six complete sets of operating and maintenance manuals, duly approved by the Consultant, shall be supplied by the Contractor, prior to hand over of the project to the owner. Each set shall be permanently bound and shall have a hard cover. Each manual shall be inscribed with suitable legend for proper identification and use of the manual. The matter shall be legibly typed and/or shall be clear Photostat copies of the original documents, catalogues, etc. Flysheets shall be placed before instructions covering each subject. The instruction sheets shall be approximately 8 ½" x 11", with large sheets of drawings folded in. The manual shall be arranged in two parts, and shall generally conform to the arrangement shown below.

Part I – Systems

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

2. The material for each system shall then be organize in sections descriptive of the following basic areas of information:

    (a) Descriptive Information
    (b) Operating Instructions
    (c) Inspection and maintenance instructions.

3. Sections shall be organized to include the following categories of information:

    (a) Descriptive Information:

        (1) Function of service.
        (2) Classification.
        (3) Design Capability.
        (4) Performance characteristics.
        (5) Principal components.
        (6) Distribution arrangement.
        (7) Schematic diagram.
        (8) Control diagram.
        (9) Equipment data:

            (a) Inventory designation.
            (b) Manufacturer and Model.
            (c) Size and rating.
            (d) Pressure, speed, and temperature limitations.

(b) Operating Instructions:

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

(c) Inspection and Maintenance:

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

4. Reference Documents.

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

Part II – Equipment

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

Division Title

Air-conditioning & Ventilation	..	1
Controls	..	2
Instruments & Accessories ..	..	3
Motors	..	4
Refrigeration	..	6
Starters	..	7
Valves	..	8

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

Air Conditioning & Ventilating	..	1.0
Coils – cooling ..	..	1.1
– preheat ..	..	1.2
– reheat ..	..	1.3
Fans – axial ..	..	1.4
– centrifugal ..	..	1.5

– propeller	..	..	1.6
Filters – roughing	..	..	1.7
– intermediate	..	..	1.8
terminal	..	..	1.9
Humidifier – central	..	..	1.10
– duct	..	..	1.11
Other equipment	..	..	1.12

3. Coverage of section. Each section shall include the following manufacturer information:

(a) Descriptive literature

(1) Catalogue cuts, brochures, or shop drawings.
(2) Dimensional drawings.
(3) Materials of constructions.
(4) Parts designations.

(b) Operating characteristics:

(1) Performance tables and charts.
(2) Performance curves.
(3) Pressure, temperature and speed limitations.
(4) Safety devices.

(c) Operating Instructions:

(1) Prestart checklist.
(2) Start-up procedures.
(3) Inspection during operation.
(4) Adjustment andregulations.
(5) Testing.
(6) Detection of malfunction.
(7) Precautions.

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

(e) Maintenance Instructions and Procedures

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

(f) Parts List.

(g) Spare parts.

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

(h) Service Contracts.

12.2 FRAMED INSTRUCTIONS:

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

12.3 FIELD INSTRUCTIONS:

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

13.0 TEST RUN

13.1 GENERAL:

After completion of the installation of the Systems the Contractor shall carry out a two months' test run in summer or as per direction of the Client or Project Managers. The certificate of substantial completion shall be provided on completion of the test run to the satisfaction of the Client / Project Managers and in keeping with the stipulations of relevant clauses of the General & Special Conditions of Contract. This test run shall be constructed to form a part of the "Performance Tests" specified herein before.

14.0 LIST OF APPROVED MANUFACTURERS:

S.NO.	EQUIPMENT / MATERIAL	RECOMMENDED MANUFACTURERS
1	AIR HANDLING UNITS	a) UNTES b) DAIKIN c) MITSUBISHI d) SABRO OR EQUIVALENT/ as per site engineer approval
2	BMS	b) JOHNSON CONTROLS b) HONEYWELL c) EASY I/O d) OR EQUIVALENT/ as per site engineer approval
3	GI SHEET FOR DUCTS	a) PAKISTAN STEEL b) JAPAN MAKE c) ISL MAKE d) OR EQUIVALENT/ as per site engineer approval
4	VOLUME DAMPERS	a) THERMEC, PAKISTAN b) WESTERN AIR DUCT, PAKISTAN c) STEEL CRAFT, PAKISTAN d) AIR GUIDE e) OR EQUIVALENT/ as per site engineer approval
5	FLEXIBLE DUCTS WITH INSULATION	a) ATCO b) AFS c) OR EQUIVALENT/ as per site engineer approval
6	AIR DISTRIBUTION OUTLETS	a) THERMEC, PAKISTN b) WESTERN AIRDUCTS, PAKISTAN c) STEEL CRAFT, PAKISTAN d) AIR GUIDE e) OR EQUIVALENT/ as per site engineer approval
7	LAMINAR FLOW DIFFUSER, AIR FILTER	a) CAMFIL b) AAF c) TROX d) AIR GUIDE e) OR EQUIVALENT/ as per site engineer approval
8	FIBRE GLASS INSULATION	a) KIMMCO b) AFICO c) KNAUF d) KLAFT e) OR EQUIVALENT/ as per site engineer approval
9	HANGERS & SUPPORTS	a) INKA b) NORM c) SIKLA

		d) OR EQUIVALENT/ as per site engineer approval
10	VIBRATION ISOLATION	a) KINETICS b) MASON c) TARIQ ENGINEERING d) OR EQUIVALENT/ as per site engineer approval
11	HVAC FANS	a) AEROTECH b) SABRO c) OR EQUIVALENT/ as per site engineer approval
12	ELECTRIC CABLES	a) PAKISTAN CABLES b) UNIVERSAL CABLES c) PIONEER CABLES d) OR EQUIVALENT/ as per site engineer approval
13	BMS, CONTROL AND COMMUNICATION CABLES	a) BELDEN b) FIRECELL c) PRYSMIAN d) PONI e) OR EQUIVALENT/ as per site engineer approval
S.NO.	**EQUIPMENT / MATERIAL**	**RECOMMENDED MANUFACTURERS**
14	COPPER PIPING	a) MUELLER, USA b) YORKSHIRE, UK c) CRANE ENFIELD, AUSTRALIA d) OR EQUIVALENT/ as per site engineer approval
15	UPVC PIPING	a) NEPRO b) VESBO c) COSMOPLAST d) JEDDAH POLYMER e) OR EQUIVALENT/ as per site engineer approval
16	VARIBALE FREQUENCY DRIVE	a) SIEMENS b) DANFOSS c) DELTA d) SCHNIEDER e) OR EQUIVALENT/ as per site engineer approval
17	ELECTRIC MOTORS	a) SIEMENS OR EQUIVALENT/ as per site engineer approval

18	PVC CONDUIT FOR HVAC ELECTRICAL & BMS WORKS (POWER, CONTROL & COMMINUCATION WIRING – CONCEALED / RECESSED APPLICATION) GI CONDUIT FOR HVAC ELECTRICAL & BMS WORKS (POWER, CONTROL & COMMUNICATION WIRING – SURFACED / EXPOSED / ABOVE FALSE CEILING APPLICATION)	a) HILAL, PAKISTAN b) PREMIER, PAKISTAN c) DADEX, PAKISTAN d) IIL, PAKISTAN e) OR EQUIVALENT/ as per site engineer approval
19	DX SPLIT AC UNIT	a) HISENSE b) DAIKIN c) MITSUBISHI d) OR EQUIVALENT/ as per site engineer approval
20	ADHESIVE AND SEALENT	a) ZAHABIYA b) OR EQUIVALENT/ as per site engineer approval
21	CLOSED CELL FOAM INSULATION	a) AEROFLEX b) SUPERLON c) ARMACELL d) OR EQUIVALENT/ as per site engineer approval
22	REINFORCED FSK FACING ALUMINIUM FOIL TAPE	a) ABRO b) OR EQUIVALENT/ as per site engineer approval
23	DUCT LINER	a) KNAUF b) MANSON c) AFICO d) DURADINE e) OR EQUIVALENT/ as per site engineer approval