HOME DEPARTMENT
GOVERNMENT OF SINDH

ESTABLISHMENT OF
FORENSIC SCIENCE LABORATORY IN SINDH AT KARACHI

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF REMAINING WORKS - CARGO ELEVATOR, HVAC DUCTING, DIESEL GENERATOR & ALLIED WORKS, FM200 AND ELV SYSTEM AT SINDH FORENSIC SCIENCE LABORATORY AT KARACHI

BIDDING & CONTRACT DOCUMENTS

VOLUME I

Invitation for Bids
Instructions to Bidders with Appendices (A-C)
Letter of Technical Bid
Schedules (A-L) to Bid
Preamble to Conditions of Contract
General Conditions of Contract
Particular Conditions of Contract
Standard Forms

APRIL 2025

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INVITATION FOR BIDS

PROJECT IMPLEMENTATION UNIT
SINDH FORENSIC SCIENCE LABORATORY KARACHI
HOME DEPARTMENT
GOVERNMENT OF SINDH

INVITATION FOR BIDS
SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF REMAINING WORKS - CARGO ELEVATOR, HVAC DUCTING, DIESEL GENERATOR & ALLIED WORKS, FM200 AND ELV SYSTEM AT SINDH FORENSIC SCIENCE LABORATORY AT KARACHI

1. Project Director, Sindh Forensic Science Laboratory at Karachi, Pakistan, (the "Employer") invites electronic bids through E-PADS Single Stage Two Envelopes Bidding Procedure SPP Rule 46(2) Amended up to date, from firms registered with Income Tax and SRB licensed by Pakistan Engineering Council in category C-1 & above (specialization code ME-02, ME-03, ME04, EE01,EE02, EE03, EE07, EE08, EE09 & CE-10) as under .

S #	Name of Work	Tender Fee Non-Refundable	Estimated cost in Million	Bid Security Refundable	Completion Period
1	Establishment of Sindh Forensic Science Laboratory Karachi. Supply, Installation, Testing & Commissioning of Remaining Works – Cargo Elevator, Diesel Generator & Allied Works, HVAC Ducting, FM200 and ELV System	**Rs. 20,000/-**	**Rs. 1683.00 Million**	**5%**	**12 Months**

2. E-bidding documents as per regulations, containing detailed terms and conditions, specifications and requirements etc. are available for the registered bidders on EPADS at (www.sindh.eprocure.gov.pk). Documents are available from 5th May 2025 to 20th May 2025. Tender Fee submission is a mandatory requirement, Original Tender Receipt shall be verified prior to opening of Bids. All prospective bidders are instructed to submit Tender Fee in the form of pay order (in original) on or before 16th May 2025 COB at Office of the Project Implementation Unit- SFSL. No Bids shall be accepted whose Tender Fee is not received as per above mentioned deadline.
3. Bid Security shall be in favor of the Project Director, Sindh Forensic Science Laboratory, Karachi.
4. Moreover, Conditional tender, submission without the proof of earnest money, without the tender fee or any other procedural flaw(s) if found as per rules 41 (7) under SPPR 2010, will also not be considered in the competition. Earnest money of the unsuccessful bidders shall be returned as per provision of bidding documents.
5. The Procuring Agency reserves the right to reject any or all bids subject to relevant provisions of SPP Rule, 2010 (Amended up to date) and may cancel the bidding process at any time prior to the acceptance of a bid or proposal under Rule-25" of said Rules.
6. The electronic bids must be submitted by using EPADS on or before 1100 hours, on 20th May, 2025). Manual bids shall not be accepted. Electronic Bids (Technical Bids) will be opened at 1130 hours on the same day, in the presence of bidders' representatives who choose to attend at the same address.
7. All Price bids must be accompanied with a Bid Security @ 5% of Bid amount in the form of Bank Guarantee or Pay Order issued in favor of Project Director, Sindh Forensic Science Laboratory at Karachi. Bidders must submit Original Bid Security & Original Tender Receipt on 20th May 2025, on or before 1100 hrs at the address given below. Failure to submit original Bid Security & Original Tender Receipt shall result in disqualification of the bidder.
8. Scanned copies of all documents as mentioned in the Bidding documents shall be uploaded through E-PADS while submitting e-bid.

Procurement Committee Chairman
Project Implementation Unit, Sindh Forensic Science Laboratory at Karachi
PIU Office 203, 2nd Floor, Ibrahim Trade Centre, Shahr-e-Faisal
Karachi, Email: sindhforensicsciencelaboratory@gmail.com

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INSTRUCTIONS TO BIDDERS

A. GENERAL

IB.1 Scope of Bid

1.1 The Employer as defined in the **Bidding Data** hereinafter called "the Employer" wishes to receive bids for the construction and completion of works as described in these Bidding Documents, and summarized in the **Bidding Data** hereinafter referred to as the "Works".

1.2 The successful Bidder will be expected to complete the Works within the time specified in the **Bidding Data**.

IB.2 Source of Funds

2.1 The Employer has applied for/received a funding from the source(s) in various currencies towards the cost of the project specified in the **Bidding Data** and it is intended that part of the proceeds of this funding will be applied to eligible payments under the Contract for which these Bidding Documents are issued.

IB.3 Eligible Bidders

3.1 This Invitation for Bids is open to all Bidders meeting the following requirements at the time of submission of Bids and thereafter:

(a) Duly eligible for this bidding process;

(b) Duly licensed by the Pakistan Engineering Council (PEC) in the category relevant to the value of the Works in the relevant field of specialization.

However, a Foreign Constructor can submit provisional licence with its Bid but the Foreign Constructor will be required to submit standard licence after award of Contract and before start of work.

Foreign Constructor shall not be eligible to participatein bidding individually. Foreign Constructor shall enter into joint venture with Pakistani Constructor registered with the Pakistan Engineering Council in equivalent/compatible category and submit the joint venture agreement to the Employer before participating in bidding in accordance with PEC Construction and Operation of Engineering Works Bye-laws, 1987;

(c) Pakistani Constructor must be on Active Taxpayer List of the Federal Board of Revenue and provincial revenue authority/ board where applicable; and

(d) All partners constituting the Bidder including proposed subcontractors do not appear in the list of debarred/ blacklisted firms and individuals on the websites of PEC and Federal & Provincial Procurement Regulatory Authorities and have not been declared debarred/ blacklisted by foreign country, international organizations or other foreign institutions.

IB.4 Eligible Materials, Equipment and Services

4.1 All materials, equipment and services to be supplied under this Contract shall have their origin in eligible countries described under paragraph 4.4 hereunder.

4.2 For purpose of this Clause, "origin" means the place where the Goods are mined, grown or produced or from where the ancillary services are supplied. Goods are produced when, through manufacturing, processing or substantial and major assembling of components, a commercially recognized product results that is substantially different in basic characteristics or in purpose or utility from its components.

4.3 The origin of Goods and Services is distinct from the nationality of the Bidder.

4.4 Eligible countries to participate in this bidding process are those which have been notified by Ministry of Interior, Government of Pakistan as Business Friendly Countries (BVL); information can be accessed through following link:

http://www.dgip.gov.pk/Files/Visa%20Categories.aspx#L

IB.5 One Bid per Bidder

5.1 Each Bidder shall submit only one Bid either by himself, or as a partner in a joint venture. A Bidder who submits or participates in more than one Bid (other than alternatives pursuant to Clause IB.17) will be disqualified.

IB.6 Site Visit

6.1 The Bidders are advised to visit and examine the Site of Works and its surroundings and obtain for themselves on their own responsibility all information that may be necessary for preparing the Bid and entering into a contract for construction of the Works. All cost in this respect shall be at the Bidder's own expense.

6.2 The Bidders and any of their personnel or agents will be granted permission by the Employer to enter upon his premises and lands for the purpose of such inspection, but only upon the express condition that the Bidders, their personnel and agents, will release and indemnify the Employer, his personnel and agents from and against all liability in respect thereof and will be responsible for death or personal injury, loss of or damage to property and any other loss, damage, costs and expenses incurred as a result of such inspection.

B. BIDDING DOCUMENTS

IB.7 Contents of Bidding Documents

7.1 The Bidding Documents, in addition to Invitation for Bids,are those stated below and should be read in conjunction with any Addenda issued in accordance with Clause IB.9:

1. Instructions to Bidders;
2. Bidding Data;
3. Evaluation Criteria and Qualification Updating Forms;
4. General Conditions (GC);
5. Particular Conditions (PC):
   Part A - Contract Data;
   Part B - Special Provisions;
6. Specifications (SP):
   Part A - Specific Provisions;
   Part B - Technical Provisions;
7. Letter of Bid;
8. Schedules to Bid;
9. Standard Forms:
   (i) Form of Bid Security;
   (ii) Letter of Acceptance;
   (iii)Form of Contract Agreement;
   (iv)Form of Performance Security;
   (v) DAAB Agreement;
   (vi)Form of Mobilization Advance Guarantee;
10. Drawings.

7.2 The Bidders are expected to examine carefully the contents of all the above documents. Failure to comply with the requirements of Bid submission will be at the Bidder's own risk. Pursuant to Clause IB.26, bids which are not substantially responsive to the requirements of the Bidding Documents will be rejected.

IB.8 Clarification of Bidding Documents, Pre-Bid Meeting

8.1 Any prospective Bidder requiring any clarification(s) in respect of the Bidding Documents may notify the Employer in writing at the Employer's address indicated in theInvitation for Bids. The Employer will respond to any request for clarification which he receives earlier than the periodspecified in the **Bidding Data**, prior to the deadline for submission of bids.

8.2 Copies of the Employer's response will be forwarded to all purchasers of the Bidding Documents, including a description of the enquiry but without identifying its source.

8.3 The Employer may, on his own or at the request of any prospective Bidder(s), hold a pre-bid meeting to clarify issues and to answer any questions on matters related to the Bidding Documents. The date, time and venue of pre-bid meeting, if convened, are as stipulated in the **Bidding Data**. All prospective Bidders or their authorized representatives shall be invited to attend such a pre-bid meeting.

8.4 The Bidders are requested to submit questions, if any, in writing so as to reach the Employer not later than seven (7) days before the proposed pre-bid meeting.

8.5 Minutes of the pre-bid meeting, including the text of the questions raised and the replies given, will be transmitted without delay to all purchasers of the Bidding Documents. Any modification of the Bidding Documents listed in Sub- Clause IB.7.1 hereof which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause IB.9 and not through the minutes of the pre-bid meeting.

8.6 Absence at the pre-bid meeting will not be a cause for disqualification of a Bidder.

IB.9 Amendment of Bidding Documents

9.1 At any time prior to the deadline for submission of bids, the Employer may, for any reason, whether at his own initiative or in response to a clarification requested by a prospective Bidder, modify the Bidding Documents by issuing addendum.

9.2 Any addendum thus issued shall be part of the Bidding Documents listed in Sub-Clause IB.7.1 hereof and shall be communicated in writing to all purchasers of the Bidding Documents. Prospective Bidders shall acknowledge receipt of each addendum in writing to the Employer.

9.3 Such addendum shall be issued not later than number of days prior to the deadline for submission of bids, specified in the **Bidding Data**. To afford prospective Bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may extend the deadline for submission of bids in accordance with Clause IB.20.

C. PREPARATION OF BIDS

IB.10 Cost of Bidding

10.1 The Bidders shall bear all costs associated with the preparation and submission of their respective bids and the Employer will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

IB.11 Language of Bid

11.1 The Bid and all correspondence and documents related to the Bid exchanged by a Bidder and the Employer shall be in the Bid language stipulated in the **Bidding Data** and Particular Conditions of Contract. Supporting documents and printed literature furnished by the Bidders may be in any other language provided the same are accompanied by duly certified translation of the relevant parts in the Bid language, in which case, for purposes of evaluation of the bid, the translation in Bid language shall prevail.

IB.12 Documents Comprising the Bid

12.1 Each Bidder shall:

(a) submit duly filled in, signed and stamped Letter of Bid and completed Schedules to Bid as required, including priced Bill of Quantities, in accordance with ClauseIB.18 hereof;

(b) submit Bid Security in accordance with Clause IB.16 hereof;

(c) submit alternative proposal, if permissible in accordance with Clause IB.17;

(d) submit a written power of attorney authorizing the signatory of the Bid to act for and on behalf of the Bidder. The name and position held by each person signing the authorization must be typed or printed below the signature;

(e) submit the Qualification Updating Forms duly filled in, signed and stamped along with requisite attachments, to establish that the Bidder continues to meet the Eligibility and Qualification Criteria set out in the Pre-Qualification Documents and as provided in the Section "Evaluation Criteria and Qualification Updating Forms";

(f) furnish a technical proposal taking into account the various Schedules to Bid, specially the following:

Schedule-C to Bid, Proposed Construction Schedule;

Schedule-D to Bid, Method of Performing the Work;

Schedule-E to Bid, List of Major Equipment;

Schedule-F to Bid, Organization Chart for Supervisory Staff;

and other pertinent information, such as mobilization programme, etc.

12.2 Bids submitted by a joint venture of two (2) or more firms specified in **Bidding Data**, shall comply with the following requirements:

(a) the bid, and in case of a successful bid, the Form of Contract Agreement shall be signed by all members so as to be legally binding on all partners;

(b) one of the joint venture partners shall be nominated as being in-charge; and this authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the joint venture partners;

(c) the partner-in-charge shall always be duly authorized to deal with the Employer regarding all matters related with and/or incidental to the execution of Works as per the terms and Conditions of Contract and in this regard to incur any and all liabilities, receive instructions, give binding undertakings and receive payments on behalf of the joint venture;

(d) all partners of the joint venture shall at all times and under all circumstances be liable jointly and severally for the execution of the Contract in accordance with the

Contract terms and a statement to this effect shall be included in the authorization mentioned under Sub-Para(b) above as well as in the Letter of Bid and in the Form of Contract Agreement (in case of a successful bid); and

(e) a copy of the agreement entered into by the joint venture partners shall be submitted with the bid stating the conditions under which it will function, its period of duration, the persons authorized to represent andobligate it and which persons will be directly responsible for due performance of the Contract and can give valid receipts on behalf of the joint venture, the proportionate participation and corresponding duties& responsibilities of the several firms forming the joint venture, and any other information necessary to permita full appraisal of its functioning. No amendments/ modifications whatsoever in the joint venture agreementshall be agreed to between the joint venture partners without prior written consent of the Employer.

12.3 Bidders shall also submit proposals of work methods and schedule, in sufficient detail to demonstrate the adequacy of the Bidders' proposals to meet the technical specifications and the completion time referred to in Sub-Clause IB.1.2 hereof.

IB.13 Bid Prices

13.1 The price and discount if any quoted by the Bidders in the Letter of Bid and in the Bill of Quantity shall conform to the requirement specified below:

13.2 The Bidder shall quote any discounts and the methodology for their application.

13.3 If bids are being invited for individual lots (contracts) or for any combination of lots, the Bidders can offer discounts for the individual lots (contracts) as well as for award of more than one Contract and shall specify in their bid.

13.4 Unless stated otherwise in the Bidding Documents, the Contract shall be for the whole of the Works as described in Sub-Clause IB.1.1 hereof, based on the unit rates and/or prices.

13.5 The Bidders shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by a Bidder will not be paid for by the Employer when executed and shall be deemed covered by rates and prices for other items in the Bill of Quantities.

13.6 All duties, taxes and other levies payable by the Contractor under the Contract, or for any other cause, as on the date 28 days prior to the deadline for submission of bids shall be included in the rates and prices and the total Bid Price submitted by a Bidder.

Additional/reduced duties, taxes and levies due to subsequent additions or changes in legislation shall be reimbursed/ deducted as per Sub Clause 13.6 [*Adjustment for Changes in Laws*] of the Conditions of Contract.

13.7 The rates and prices quoted by the Bidders are subject to adjustment during the performance of the Contract in accordance with the provisions of Sub-Clause 13.7 [*Adjustments for Changes in Cost*] of the General Conditions of Contract. The Bidders shall furnish the prescribed information for the price adjustment formulae in Schedule-A to Bid, and shall submit with their bids such other requisite supporting information if required under the said Schedule.

IB.14 Currencies of Bid and Payment

14.1 The unit rates and the prices shall be quoted by the Bidder entirely PKR.

A Bidder expecting to incur expenditures in other currencies for inputs to the Works supplied from outside the Employer's country (referred to as the "Foreign Currency Requirements") shall indicate in Table III of Schedule-A to Bid the proportion of the Bid Price (excluding Provisional Sums) needed by him for the payment of such Foreign Currency Requirements; in such case the unit rates and the prices shall be quoted by the Bidder in Equivalent PKR.

14.2 The rates of exchange to be used by the Bidder for currency conversion shall be the TT Selling Rates published or authorized by the State Bank of Pakistan prevailing on the date twenty eight (28) days prior to the deadline for submission of bids. Such rates shall be notified by the Employer not later than fourteen (14) days prior to the deadline for submission of Bids.

For the purpose of payments, the exchange rates used in Bid preparation shall apply for the duration of the Contract.

IB.15 Bid Validity

15.1 Bids shall remain valid for the period stipulated in the **Bidding Data** after the date of Bid Opening specified inClause IB.23.

15.2 In exceptional circumstances, prior to expiry of the original bid validity period, the Employer may request that the Bidders extend the period of validity for a specified additionalperiod which normally may not be more than the original bid validity period. The request and the responses thereto shall be made in writing. A Bidder may refuse the request without forfeiting his Bid Security. A Bidder agreeing to the request will not be required or permitted to modify his bid, but will berequired to extend the validity of his Bid Security for the period of the extension, and in compliance with Clause IB.16 in all respects.

IB.16 Bid Security

16.1 Each Bidder shall furnish, as part of his bid, a Bid Security in original form in the amount stipulated in the **Bidding Data** in PKR or an equivalent amount in a freely convertible currency.

16.2 The Bid Security shall be, at the option of the Bidder, in the form of Call Deposit Receipt (CDR)/ Pay Order or a Security issued in the prescribed form included in the Bidding Documents, by (a) a Scheduled Bank in Pakistan or (b) a foreign bank duly counter-guaranteed by a Scheduled Bank in Pakistan or (c) an Insurance Company listed in the **Bidding Data** and rated by PACRA/VIS of rating as provided in Table below in favour of the Employer valid for a period 14 days beyond the Bid Validity date. The Bid Security of Joint Venture shall be in the name of Joint Venture or Lead/either Firm of the JV or in ratio of shares of the individual JV partners, submitting the bid.

Bid Price (In Eq. million PKR)	Minimum Rating of Insurance Companies
Up to 1000	A (+)
1001 to no limit	AA
[Note: Insurance Company includes Joint Ventures of Insurance Companies also]	

16.3 Any Bid not accompanied by an acceptable Bid Security shall be rejected by the Employer as non-responsive.

16.4 The Bid Securities of the Bidders except the lowest three will be returned by the Employer within twenty eight (28) days from the opening of Bids, provided a Bidder requests for the return of its Bid Security, or upon the expiry of original validity of Bid Security or as extended, whichever is earlier.

16.5 The Bid Security of the lowest three Bidders including the successful Bidder will be returned when the successful Bidder has furnished the required Performance Security.

16.6 The Bid Security may be forfeited:

(a) if the Bidder withdraws his bid except as provided in Sub Clause IB.22.1;

(b) if the Bidder does not accept the correction of his Bid Price pursuant to Sub Clause IB.28.2 hereof; or

(c) in the case of successful Bidder, fails to furnish the required Performance Security.

16.7 In case of annulment, all Bids submitted and specially, Bid securities, shall be returned to the Bidders within 14 days of annulment.

IB.17 Alternative Proposals by Bidder

17.1 Unless otherwise specified in the **Bidding Data**, alternative proposal(s) shall not be considered.

17.2 Should any Bidder consider that he can offer any advantages to the Employer by a modification to the designs, specifications or other conditions, he may, in addition to his Bid to be submitted in strict compliance with the Bidding Documents, submit any alternative proposal(s) containing

(a) relevant design calculations; (b) technical specifications; (c) proposed construction methodology; and (d) any other relevant details/conditions, provided always that the total sum entered on the Letter of Bid shall be that which represents complete compliance with the Bidding Documents.

17.3 Alternative proposal(s), if any, of the Bidder having submitted most advantageous Bid only may be considered by the Employer as the basis for the award of Contract to such Bidder.

IB.18 Format and Signing of Bid

18.1 Bidders are particularly directed that the amount entered on the Letter of Bid shall be for performing the Contract strictly in accordance with the Bidding Documents.

18.2 All Schedules to Bid are to be properly completed and signed.

18.3 No alteration is to be made in the Letter of Bid nor in the Schedules thereto except in filling up the blanks as directed. If any such alterations be made or if these instructions be not fully complied with, the Bid may be rejected.

18.4 Each Bidder shall prepare by filling in the forms completely and without alterations one (1) original and number of copies, specified in the **Bidding Data**, of the documents comprising the Bid as described in Clause IB.12 and clearly mark them "ORIGINAL" and 'COPY" as appropriate. In the event of discrepancy between them, the original shall prevail.

The Bidder shall also provide complete searchable PDF versions as well as Word, Excel, etc., versions of the Bid if so required in the **Bidding Data**.

18.5 The original of the Bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorizedto sign on behalf of the Bidder pursuant to Sub-Clause IB.12.1(d) hereof. All pages of the Bid shall be initialled and stamped by the person or persons signing the bid.

18.6 The Bid shall contain no alterations, omissions or additions, except to comply with instructions issued by the Employer, or as are necessary to correct errors made by the Bidder, inwhich case such corrections shall be initialled by the personor persons signing the Bid.

18.7 Bidders shall indicate in the space provided in the Letter of Bid their full and proper addresses at which notices may be legally served on them and to which all correspondence in connection with their bids and the Contract is to be sent.

18.8 Bidders should retain a copy of the Bidding Documents and the Bid as their file copy.

18.9 All documents executed outside Pakistan required to be submitted with the Bid must be certified by Pakistani Embassy in the respective country(ies).

D. SUBMISSION OF BIDS

IB.19 Sealing and Marking of Bids

19.1 Each Bidder shall submit his Bid as under:

(a) ORIGINAL and each copy of the Bid shall be separately sealed and put in separate envelopes and marked as such.

(b) The envelopes containing the ORIGINAL and copies will be put in one sealed envelope and addressed / identified as given in Sub Clause IB.19.2 hereof.

19.2 The inner and outer envelopes shall:

(a) be addressed to the Employer at the address provided in the **Bidding Data**;

(b) bear the specific identification of this bidding process as specified in the **Bidding Data**; and

(c) provide a warning not to open before the time and date for bid opening, as specified in the **Bidding Data**.

19.3 In addition to the identification required in Sub-Clause IB.19.2 hereof, the inner envelope shall indicate the name andaddress of the Bidder to enable the Bid to be returned unopened in case it is declared "late" pursuant to ClauseIB.21.

19.4 If the outer envelope is not sealed and marked as above, the Employer will assume no responsibility for the misplacement or premature opening of the Bid.

IB.20 Deadline for Submission of Bids

20.1 (a) Bids must be received by the Employer at the address specified no later than the time and date stipulated in the **Bidding Data**.

(b) Bids with charges payable will not be accepted, nor will arrangements be undertaken to collect the bids from any delivery point other than that specified above. Bidders shall bear all expenses incurred in the preparation and delivery of Bids. No claims will be entertained for refund of such expenses.

(c) Where delivery of a Bid is by mail and the Bidder wishes to receive an acknowledgment of receipt of such Bid, he shall make a request for such acknowledgment in a separate letter attached to but not included in the sealed Bid envelope.

(d) Upon request, acknowledgment of receipt of Bids will be provided to those making delivery in person or by messenger.

20.2 The Employer may, at his discretion, extend the deadline for submission of Bids by issuing an amendment in accordance with Clause IB.9, in which case all rights and obligations ofthe Employer and the Bidders previously subject to the original deadline will thereafter be subject to the deadline as extended.

IB.21 Late Bids

21.1 (a) Any Bid received by the Employer after the deadline for submission of bids prescribed in Clause IB.20 shall be declared late, rejected and returned unopened to such Bidder.

(b) Delays in the mail, delays of person in transit, or delivery of a Bid to the wrong office shall not be accepted as an excuse for failure to deliver a Bid at the proper place and time. It shall be the Bidder's responsibility to determine the manner in which timely delivery of his Bid will be accomplished either in person, by messenger or by mail.

IB.22 Modification, Substitution and Withdrawal of Bids

22.1 Any Bidder may modify**,** substitute or withdraw his Bid after Bid submission provided that the modification, substitution or written notice of withdrawal is received by the Employerprior to the deadline for submission of bids.

22.2 The modification, substitution, or notice for withdrawal of any Bid shall be prepared, sealed, marked and delivered in accordance with the provisions of Clause IB.19 with the outer and inner envelopes additionally marked "MODIFICATION", "SUBSTITUTION" or "WITHDRAWAL" as appropriate.

22.3 No Bid may be modified by a Bidder after the deadline for submission of Bids except in accordance with Sub Clauses IB.22.1 and 28.2.

22.4 Withdrawal of a Bid during the interval between the deadline for submission of Bids and the expiration of the period of Bid validity specified in the Letter of Bid may result in forfeiture of the Bid security in pursuance to Clause IB.16.

E. BID OPENING AND EVALUATION

IB.23 Bid Opening

23.1 The Employer will open the Bids including withdrawals, substitution and modifications made pursuant to Clause IB.22, in the presence of Bidders' representatives who choose to attend, at the time, date and location stipulated in the **Bidding Data**. The Bidders' representatives who are present shall sign a register evidencing their attendance.

23.2 Envelopes marked "MODIFICATION", "SUBSTITUTION" or "WITHDRAWAL" shall be opened and read out first. Bids for which an acceptable notice of withdrawal has been submitted pursuant to Clause IB.22 shall not be opened. Only bids that are opened and read out at Bid opening shall be considered further.

23.3 The Bidder's name, total Bid Price and price of any alternative proposal(s), any discounts, Bid modifications**,** substitution and withdrawals, the presence or absence of Bid security, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening of Bids. Only discounts and alternative proposals

read out at Bid opening shall be considered for evaluation. The Letter of Bid and the Summary Bill of Quantities are to be initialled by representative(s) of the Employer attending Bid opening. The Employer shall neither discuss the merits ofany Bid nor reject any Bid (except for late Bids, in accordance with Sub-Clause IB 21.1).

23.4 The Employer shall prepare minutes of the Bid opening, including the information disclosed to those present in accordance with the Sub-Clause IB.23.3.

IB.24 Process to be Confidential

24.1 Information relating to the examination, clarification, evaluation and comparison of Bids and recommendations for the award of Contract shall not be disclosed to Bidders or any other person not officially concerned with such process before the announcement of the result of Bid evaluation in the form of final evaluation report giving justification for acceptance or rejection of Bids which shall be done at least fifteen (15) days prior to award of Contract. The announcement to all Bidders will include table(s) comprising read out prices, discounted prices, price adjustments made, final evaluated prices and recommendations against all the Bids evaluated. Any effort by a Bidder to influence the Employer's processing of Bids or Contract award decisions may result in the rejection of such Bidder's Bid. Whereas any Bidder feeling aggrieved may lodge a written complaint not later than five (5) days after the announcement of the final evaluation report.

IB.25 Clarification of Bids

25.1 To assist in the examination, evaluation and comparison of Bids, the Employer may, at his discretion, ask any Bidder for clarification of his Bid, including breakdowns of unit rates and lump sum prices. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The request for clarification and the response shall be in writing. No change in the price or substance of the Bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids in accordance with Clause IB.28.

25.2 The Employer may, at his discretion, ask any Bidder for confirmation/submission of missing information to clarify its Bid. However, the Employer does not have an obligation to request any additional information or clarification with respect to missing or deficient information in a Bid. TheEmployer may reject any Bid as non-responsive if found materially incomplete, obscure, irregular or omitting any material information required to be submitted in accordance with the Bidding Documents.

25.3 If a Bidder does not provide clarifications of its Bid by the date and time set reasonably (not less than seven (7) days) in the Employer's request for clarification, the Employer may proceed with the evaluation based on the informationsubmitted in the Bid without waiting for the Bidder's response.

IB.26 Examination of Bids and Determination of Responsiveness

26.1 Prior to the comparison of Bids, the Employer will determine whether each Bid is substantially responsive to the requirements of the Bidding Documents.

26.2 The Employer's determination of a Bid's responsiveness is to be based on the contents of the Bid itself, as defined in Sub-Clause IB.12.

26.3 A substantially responsive Bid is one which meets the requirements of the Bidding Documents, without material deviation, reservation or omission. A material deviation, reservation or omission is one that,

(a) if accepted, would:

(i) affect in any substantial way the scope, quality or performance of the Works; or

(ii) limit in any substantial way, inconsistent with the Bidding Documents, the Employer's rights or the Bidder's obligations under the proposed Contract; or

(b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive Bids.

26.4 During the evaluation of Bids, the following definitions apply:

(a) "Deviation" is a departure from the requirements specified in the Bidding Documents;

(b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of therequirements specified in the Bidding Documents; and

(c) "Omission" is the failure to submit part or all of the information or documentation required in the Bidding Documents.

26.5 The Employer shall examine the technical aspects of the Bid submitted in accordance with Sub-Clause IB.12.1(f), in particular, to confirm that all requirements stated in Specifications have been met without any material deviation, reservation or omission.

26.6 If a Bid is not substantially responsive to the requirements of the Bidding Documents, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation, reservation or omission.

IB.27 Nonmaterial Nonconformities

27.1 Provided that a Bid is substantially responsive, the Employer may waive any nonconformities in the Bid.

27.2 Provided that a Bid is substantially responsive, the Employer may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Bid related to documentation requirements. Requesting information or

documentation on such nonconformities shall not be related to any aspect of the price of the Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.

27.3 Provided that a Bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component, by adding the average price of the item or component quoted by other lowest two evaluated substantially responsive Bidders. If the price of the item or component cannot be derived from the price of other substantially responsive Bids, the Employer shall use a suitable CSR, adjusted to the date 28 days earlierto the Bid submission date or its best assessment.

IB.28 Correction of Arithmetic Errors

28.1 Bids determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:

(a) where there is a discrepancy between the amounts in figures and in words, the amount in words will govern.

(b) where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern, unless in the opinion of the Employer there is an obviously gross misplacement of the decimal point inthe unit rate, in which case the line item total as quoted will govern and the unit rate will be corrected.

(c) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected.

28.2 The amount stated in the Letter of Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and with the concurrence of the Bidder, shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected Bid Price, his Bid will be rejected, and the Bid security shall be forfeited in accordance with Sub Clause IB.16.6(b) hereof.

IB.29 Evaluation and Comparison of Bids

29.1 The Employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with Clause IB.26. The Employer shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be permitted.

29.2 In evaluating and comparing the Bids, the Employer will determine for each Bid the evaluated Bid Price by adjusting the Bid Price as follows:

(a) making any correction for arithmetic errors pursuant to Clause IB.28;

(b) price adjustment due to discounts offered in accordance with Sub-Clause IB.23.3;

(c) excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities, but including competitively priced daywork;

(d) making an appropriate price adjustment for any quantifiable nonmaterial nonconformities in accordance with Sub-Clause IB.27.3; and

(e) the additional evaluation factors are specified in Section Evaluation Criteria and Qualification Updating Forms.

29.3 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in Bids' comparison.

IB.30 Abnormally Low Bids

30.1 If the Bid Price of the successful Bidder is more than 15% below the lower of the Employer's estimate of the cost of work to be performed under the Contract or average of other lowest two evaluated substantially responsive Bids, the Employer may require the Bidder to produce detailed price analyses for any or all items of the Bill of Quantities todemonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require anadditional Performance Security by 10% of the difference of the Bid Price as determined hereinabove upto issuance of Taking Over Certificate at the expense of the successful Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract. The Bids having Bid Price lower than25% shall be liable to be rejected.

IB.31 Unbalanced or Front Loaded Bids

31.1 If the Bid of the successful Bidder is seriously unbalanced (Front Loaded) in relation to the average of other evaluated substantially responsive Bids, the Employer during execution of contract may pay against measured quantities of significantly higher quoted line item(s) rate(s) with respect to same line item(s) rate(s) determined from the average of other lowest two evaluated substantially responsive Bids as instructed by the Engineer. The balance line item(s) rate(s) may be paid against the same measured quantities at the time of issuance of Taking Over Certificate or as instructed by the Engineer.

F. AWARD OF CONTRACT

IB.32 Award Criteria

32.1 Subject to Clauses IB.33 and IB.39, the Employer will award the Contract to the Bidder whose Bid has been determined as most advantageous Bid (substantially responsive to requirements of the Bidding Documents with the lowest evaluated Bid Price).

IB.33 Employer's Right to Annul the Bidding Process

33.1 Notwithstanding Clause IB.32, the Employer reserves the right to annul the bidding process and reject all Bids, at any time prior to award of Contract, without thereby incurring any liability to the affected Bidders or any obligation.

The Employer shall upon request communicate to any Bidder who submitted a Bid, the grounds for its rejection of all Bids but is not required to justify those grounds. Rejection of all Bids shall be notified to all Bidders promptly.

IB.34 Notification of Award

34.1 Prior to expiration of the period of Bid validity prescribed by the Employer, the Employer will notify the successful Bidder in writing ("Letter of Acceptance") that his Bid has been accepted. This letter shall name the sum which the Employer will pay the Contractor in consideration of the execution and completion of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Conditions of Contract called the "Accepted Contract Amount").

The Letter of Acceptance will also state the remedies with respect to Sub-Clauses IB.30 & IB.31 if applicable.

34.2 No negotiation with the Bidder having submitted most advantageous Bid or any other Bidder shall be permitted, however, Employer may have clarification meetings before issuing Letter of Acceptance to get clarified any item in the Bid evaluation report.

34.3 The Letter of Acceptance/ notification of award and its acknowledgement/acceptance by the Bidder will constitutethe formation of the Contract, binding the Employer and the Bidder till signing of the formal Contract Agreement.

34.4 Upon furnishing by the successful Bidder of a Performance Security, the Employer will promptly notify the other Bidders that their Bids have been unsuccessful and return their Bid securities in accordance with Sub-Clause IB.16.5.

IB.35 Performance Security

35.1 The successful Bidder shall furnish to the Employer a Performance Security in the form and the amount stipulated in the Conditions of Contract and additional Performance Security if applicable under IB.30 as stated in the Letter of Acceptance, within a period of 28 days after the receipt of Letter of Acceptance.

35.2 Failure of the successful Bidder to comply with the requirements of Sub Clause IB.35.1 or Clauses IB.36 or IB.37 shall constitute sufficient grounds for the annulment of the award, forfeiture of the Bid security and to award the Contract to the Bidder having submitted next advantageous Bid.

IB.36 Signing of Contract Agreement

36.1 Within 14 days from the date of furnishing of acceptable Performance Security under the Conditions of Contract, the Employer will notify the successful Bidder to depute its representative with appropriate Power of Attorney to sign the Contract Agreement in the form provided in the Bidding Documents, incorporating all agreements between the parties.

36.2 The formal Agreement between the Employer and the successful Bidder shall be executed within 14 days of the receipt of the above stated notification by the successful Bidder from the Employer.

IB.37 Integrity Pact

37.1 The Bidder shall sign and stamp the Integrity Pact provided at Schedule-J to Bid in the Bidding Documents for all Federal Government procurement contracts exceeding PKR ten million. Failure to provide such Integrity Pact shall make the Bidder non-responsive.

IB.38 Instructions not Part of Contract

38.1 Bids shall be prepared and submitted in accordance with the Instructions to Bidders which are provided to assist the Bidders in preparing Bids but do not constitute part of the Contract.

IB.39 Corrupt and Fraudulent Practices

39.1 The Employer will reject a Bid if it determines that the Bidder recommended for award, or any of its personnel, or its agents, or its sub-contractors, service providers, suppliers and/or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract under this bidding.

39.2 The Employer will blacklist and hence forthwith debar a Constructor or individual, at any time, in accordance with the prevailing Public Procurement Rules 2004.

BIDDING DATA (BD)

BIDDING DATA

IB Clause Reference	Bidding Data
1.1	Entire text of Sub-Clause 1.1 is deleted and replaced with the following: The Employer as defined, herein below, hereinafter called "the Employer" wishes to receive bids on EPADS for the construction and completion of works as described in these Bidding Documents, and summarized, herein below, hereinafter referred to as the "Works". **Name and address of the Employer:** **Project Director** Sindh Forensic Science Laboratory at Karachi, PIU Office no. 203, 2nd Floor, Ibrahim Trade Centre, Karachi. **Name of the Project & Summary of the Works:** Supply, Installation. Testing & Commissioning of Remaining Works - Cargo Elevator, Diesel Generator & Allied Works, HVAC Ducting, FM200 and ELV System at Sindh Forensic Science Laboratory at Karachi
1.2	Time for Completion for the Works: **Whole Works: 365 days** • Cargo Elevator – 120 days • Diesel Generator – 180 days • FM 200 – 120 days • HVAC Ducting – 365 days • ELV system & other works – 365 days
2.1	Name of the Borrower/Source of Funding: The Employer has arranged funds from its own sources.
3.1(b)	The Bidder shall be duly licensed by the Pakistan Engineering Council (PEC) in the category C-1 or higher (in specialization code ME-02, ME-03, ME04, EE01,EE02, EE03, EE07, EE08, EE09 & CE-10), In case of Joint Venture (JV) each member shall have C-1 or higher category.
8.1	Entire text of Sub-Clause 8.1 is deleted and replaced with the following: Any prospective Bidder requiring any clarification(s) in respect of the Bidding Documents may notify the Employer in writing on EPADS. The Employer will respond on EPADS to any request for clarification which he receives earlier than the period as specified in Bidding Data 8.4, prior to the deadline for submission of bids. The Employer's response shall be on EPADS to all Bidders who have acquired the Bidding Document including a description of the enquiry but without identifying its source. It will be responsibility of bidders to check website for clarifications.

IB Clause Reference	Bidding Data
8.3	Venue, time, and date of the pre-Bid meeting: **Venue:** SFSL PIU Office no. 203, 2nd Floor, Ibrahim Trade Centre Karachi- **Time:** 1100 Hours **Date:** _____ , 2025.
8.4	Entire text of Sub-Clause 8.4 is deleted and replaced with the following: The Bidders are requested to submit questions, if any, in Writing on EPADS so as to reach the Employer not later than three (3) days before the proposed pre-bid meeting.
8.5	The following line is added at the end of the Sub-Clause 8.5: All such minutes, including the text of the questions raised and the replies given will be uploaded on the EPADS.
9.1	The following line is added at the end of the Sub-Clause 9.1: All such addenda shall be uploaded on the EPADS.
9.2	The following line is added at the end of the Sub-Clause 9.2: The acknowledge receipt of each addendum by the Bidders shall be submitted on the EPADS.
9.3	Number of days: Seven (07) The following line is added at the end of the Sub-Clause 9.3: All such information will be shared through EPADS.
11.1	Bid language: English
12.1	Entire text of Sub-Clause 12.1 is deleted and replaced with the following: The Bid shall comprise two envelopes submitted simultaneously on EPADS, one called the Technical Bid and the other the Price Bid, containing the following documents: **(A) Technical Bid** a) Duly filled in, signed and stamped Letter of Technical Bid in accordance with Clause IB.18 hereof,

IB Clause Reference	Bidding Data
	b) Bid Security in accordance with Clause IB.16 hereof, c) Written power of attorney authorizing the signatory of the Bid to act for and on behalf of the Bidder. The name and position held by each person signing the authorization must be typed or printed below the signature, d) Qualification Forms duly filled in, signed and stamped along with requisite attachments, to establish that the Bidder meets the Eligibility and Qualification Criteria set out in the Section"Evaluation Criteria and Qualification Forms" e) furnish a technical proposal taking into account following Schedules to Bid duly filled-in and completed in accordance with ClauseIB.18: Schedule-C to Bid [Construction Schedule] Schedule-D to Bid [Method of Performing the work] Schedule-E to Bid [List of Major Equipment] Schedule-F to Bid [Organization chart for supervisory staff & labour] Schedule-G to Bid [List of Subcontractors] Schedule-I to Bid [Construction camp and housing facilities] Schedule-J to Bid [Integrity Pact] Schedule-K to Bid [Specific Works Data] Schedule-L to Bid [List of Recommended Items/Materials/Equipment] Schedule-M to Bid [Bidder's Equipment Data] Schedule-N to Bid [Essential and Recommended Spare Parts] f) JV Agreement (if applicable) in accordance with Clause IB.12.2 hereof, and g) Any other documents required to be submitted with Technical Bid in accordance with these Bidding Documents. **(B) Price Bid** a) Duly filled in, signed and stamped Letter of Price Bid in accordance with Clause IB.18 hereof, b) Schedule-B to Bid [Bill of Quantities] duly filled-in and completed in accordance with Clause IB.18; and Schedule-H to Bid [Estimated Progress Payments] c) Any other documents required to be submitted with Price Bid in accordance with these Bidding Documents.

IB Clause Reference	Bidding Data
12.2	Maximum number of JV Partners shall be two (02).
14.1	Bidders to quote entirely in Pak. Rs. Foreign Currency Requirement are not applicable.
15.1	Period of Bid Validity: 90 days
16.1	Amount of Bid Security: @ 5% of the Bid amount The following line is added at the end of the Sub-Clause 16.1: The Bid Security shall be furnished, as part of Technical Bid. Scanned Copy of bid Security to be attached on EPADS with Technical Bid. The Original Bid Security should be submitted to the Employer on the day of bid opining, failing which bid shall be rejected.
16.2	Deleted
17.1	Alternative Proposal(s) by the Bidder shall not be considered.
18.4	The test of sub-clause 18.4 is deleted in its entirety.
19	The entire Clause IB. 19 is deleted and is replaced with the following: 19.1 Each bidder shall submit his Bid as per procedure and instructions given in training manuals of EPADS (e-Pak Acquisition and Disposal System) on PPRA website in accordance with E-Pak Procurement regulations, 2023.
20.1	The text of sub-clause IB. 20.1 (a, b, c & d) is deleted and is replaced with the following: Bids must be received by the Employer through EPADS not later than the time and date stipulated in the Invitation for Bids.
21.1	The text of sub-clause IB. 21.1 (a & b) is deleted and is replaced with the following: As per EPADS Procurement Regulations, 2023.
22.1	The text of sub-clause IB. 22.1 is deleted and is replaced with the following: A Bidder may modify or substitute his Bid on EPADS after Bid submission, prior to the deadline for submission of Bids.

IB Clause Reference	Bidding Data
22.2	The text of sub-clause IB. 22.2 is deleted and is replaced with the following: The modification, substitution or notice for withdrawal of any bid shall be submitted on EPADS.
23.1	Entire text of Sub-Clause 23.1 is deleted and replaced with the following: The Employer will open the Technical Bids including withdrawals, substitution and modifications made pursuant to Clause IB.22 on EPADS, in the presence of Bidders` representatives who choose to attend, at the address, date and time specified in the Invitation for Bids. The Bidders' representatives who are present shall sign a register evidencing their attendance. The Price Bids will remain unopened until the specified time of their opening. The 'Technical Bids' shall be opened one at a time, and the following read out and recorded: a) the name of the Bidder; b) whether there is a modification or substitution; c) the presence or absence of Bid Security with amount; and d) any other details as the Employer may consider appropriate.
23.2	The word "envelopes" on the start of the sub-clause IB. 23.2 is replaced with the word "Bids".
23.3	Entire text of Sub-Clause 23.3 is deleted and replaced with the following: At the end of the evaluation of the Technical Bids, the Employer will invite only those bidders who have submitted substantially responsive Technical Bids to attend the opening of the Price Bids on EPADS. The date, time, and location of the opening of Price Bids will be advised in writing by the Employer on EPADS. The 'Price Bids shall be opened one at a time on EPADS and the following read out and recorded: (a) the name of the Bidder; (b) whether there is a modification or substitution; (c) the Bid Prices, including any discounts; and (d) any other details as the Employer may consider appropriate. Only discounts read out at Bid opening shall be considered for evaluation. The Employer shall neither discuss the merits of any Bid nor reject any Bid (except for late Bids, in accordance with Sub-Clause IB 21.1).

IB Clause Reference	Bidding Data
25.1	The entire text of the sub-clause IB. 25.1 is deleted and replaced with following: To assist in the examination, evaluation and comparison of Bids, the Employer may, at his discretion, ask any Bidder for clarification of his Bid, including breakdowns of unit rates and lump sum prices on EPADS. Any clarification submitted by a Bidder on EPADS that is not in response to a request by the Employer shall not be considered. The request for clarification and the response shall be in writing on EPADS. No change in the price or substance of the Bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids in accordance with Clause IB.28.
25.2	The following text is added at the end of the sub-clause IB. 25.2: All such confirmation/submission of missing information shall be made through EPADS.
26.5	In second line the Sub-Clause No. IB.12.1 (f) is amended to read as 'Sub-Clause No. IB.12.1 (A)(e)' as mentioned in Bidding Data.
7.1 (3), 29.2(e)	'Qualification Updating Forms' shall be read as 'Qualification Forms'.

EVALUATION CRITERIA AND QUALIFICATION FORMS

EVALUATION CRITERIA AND QUALIFICATION FORMS

1. General

This Section contains Eligibility and Qualification Criteria that the Employer shall use to evaluate Bids and qualify Bidders in accordance with Clauses IB.26 of Instructions to Bidders.The Bidder shall provide all the information requested in the relevant forms contained in Bidder's Qualification Forms provided herein.

The information provided in the forms shall be substantiated with valid documentary evidencesotherwise the requirement will not be considered as complied.

Wherever a Bidder is required to state a monetary amount, Bidders shall indicate the PKR equivalent using the rate of exchange determined as follows:

- For financial data - Exchange rate prevailing on the last day of the respective calendar year (inwhich the amounts for that year are to be converted) was originally established.

Exchange rates shall be taken from the publicly available source identified in the Sub-ClauseIB.14.2. Any error in determining the exchange rates in the Bid may be corrected by the Employer.

2. Domestic Preference

Not Applicable

3. Evaluation (IB 29.2(e))

In addition to the criteria listed in IB 29.2 (a) - (d) the following criteria shall apply:

3.1 Assessment of adequacy of Technical Proposal with Requirements

3.2 Multiple Contracts, if permitted under Sub-Clause 1.1 of Bidding Data, will be evaluated as follows: **[Not Applicable]**

3.3 Price Adjustments, if permitted under IB.29.2(d), will be evaluated as follows:

(a) Price Adjustment for Completeness in Scope of Work

In case of omission in the scope of work of a quoted item, no price adjustment for the omitted item(s) shall be applied provided that the Bidder has mentioned in his Bid that the same is covered in any other item. Otherwise, the adjustments will be applied for comparison purpose only, taking the average price quoted by other lowest two evaluated substantially responsive Bidders in their original Bids for corresponding item. In case of non-availability of price from other Bidders, the price will be estimated by the Employerfrom a suitable CSR, adjusted to the date 28 days earlier to the Bid submission date or the Employer shall use its best assessment.

The price adjustment shall not justify any additional payment by the Employer and the price(s) of omitted item(s) shall be deemed covered by other prices of the Bill of Quantities.

(b) Price Adjustment for Technical/ Commercial Non-Compliance

The cost of making good any deficiency resulting from technical/commercial non-compliance will be added to the Corrected Total Bid Price for comparison purpose only.

The adjustments will be applied taking the average price quoted by other lowest two evaluated substantially responsive Bidders in their original Bids for corresponding item. In case of non-availability of price from other Bidders, the price will be estimated by theEmployer in accordance with sub-para (a) hereof.

3.4 Mandatory Eligibility Criteria

Only the Bidders fulfilling the following mandatory eligibility criteria shall be allowed to participate in the Bidding/Tendering process and shall be considered for evaluation (relevant documents to be attached):

1. The Bidder shall be duly licensed by Pakistan Engineering Council (PEC) in Category C-1 or higher with field of specialization ME-02, ME-03, ME-04, EE-01, EE02, EE03, EE07, EE08, EE09 & CE-10. In case, validity of license has expired for current Financial Year, the bidder must have applied for renewal of license before submission of bid. Documentary evidence of renewal application shall be submitted by Bidder.
2. Registration with Income Tax, Sindh Board of Revenue and Sales Tax Departments and the bidder is on Active Taxpayers List of Federal Board of Revenue (FBR) and Sindh Board of Revenue (SRB).
3. Affidavit on non-judicial stamp paper stating that the Bidder has not been blacklisted from any Government/Semi Government Agency/Department till date.
4. The Bidder must submit an affidavit on Judicial stamp paper affirming that it has not engaged in any forgery or fraudulent activities with any Government departments/private institutes in the past. Failure to provide the required document or any evidence contrary will render the bidder ineligible.

Note: In case of joint venture, all the partners have to meet in full the basic Eligibility Criteria mentioned at Sr. No. 2, 3 & 4 above. JV partners shall collectively meet requirement of Sr. No. 1 above wherein, all the partners shall be duly licensed by PEC.

1.2 Qualification Criteria

Keeping in view the complexity of the project works, criteria for Qualification is mentioned herein below:

Sr. No.	Category	Weightage/Marks
i.	General Capabilities	20
ii.	Experience Record	40
iii.	Financial Soundness	25
iv.	Personnel and Equipment Capabilities	15
	Total:	100

Qualification will be carried out on the point scoring basis. An applicant securing overall score of 60 or higher shall be considered as Qualified.

Note: In case of joint venture, all the partners, as combined, have to meet the aforementioned Qualification Criteria.

(**i) General Capabilities**

a)	Litigation History (For JV, Litigation History of all members to be included)	05	In case the firm or any firm of JV was involved in any litigation in which decision was against the firm, zero (0) marks will be given. 05 marks will be given in case of no such litigation has occurred. Original affidavit on Non-judicial stamp paper is to be attached. Otherwise, marks will not be awarded to the firm.
b)	Description of Internal Quality Control/Quality Assurance program for Construction/ Erection/ Operation/ Maintenance	05	05 Marks will be given if Description is provided.
c)	Sole or Authorized distributorship of major equipment/system must be of European origin	10	10 marks will be given for the provision of sole or Authorization certificate/letter for at least Elevator & Diesel Generator set. 5 Marks will be given if one certification is provided.
Total Marks Allocated			**20**

ii) Experience Record (Total Marks = 40):

I) Specific Experience (25 Marks):

Similar Nature Projects and Complexity include the Electrical Works of Medical / Forensic/Hospitals/Pharmaceutical institutes for supply, installation, testing commissioning of Diesel Generator sets, Fire Detection, Fire Alarm & ELV system in one project.

a) Full marks (25) marks shall be given if at least one (01) Projects of similar nature and complexity that have been awarded in last ten (10) years (either as a Single Entity or JV partner) amounting to not less than Pak Rs. 500 million either have successfully/substantially completed or physical performance must be around 70%.

b) 12.5 marks shall be given if at least one (01) Projects of similar nature and complexity that have been awarded in last ten (10) years (either as a Single Entity or JV partner) amounting to not less than Pak Rs. 300 million either have successfully/substantially completed or physical performance must be around 70%.

II) General Experience (15 Marks):

Similar nature and complexity include the Electrical Works of supply, installation, testing commissioning of DG sets and complete electrification works in one project.

a) Full marks (15) marks shall be given if at least one (01) Projects of similar nature and complexity that have been awarded in last five (05) years (either as a Single Entity or JV partner) amounting to not less than Pak Rs. 300 million either have successfully/substantially completed or physical performance must be around 70%.

b) 7.5 marks shall be given if at least one (01) Projects of similar nature and complexity that have been awarded in last five (05) years (either as a Single Entity or JV partner) amounting to not less than Pak Rs. 100 million either have successfully/substantially completed or physical performance must be around 70%.

Notes: (i) If a bidder (single entity or JV partner) had participated in a contract as JV partner, its share (by value) in that particular contract shall be worked out as per share in the JV agreement to meet the requirement.
(ii) The Bidder shall submit authenticated documentary evidence which may include Letter of Acceptance/Contract Agreement, Taking Over Certificate/Completion Certificate of the Contract being claimed under above mentioned criteria.

iii) Financial Soundness

Sr. No.	Description	Marks Assigned	Criteria for Marks Obtained
a)	Bank Certificate of Account Maintenance and Bank Credit Line (Evidence in Original from Bank)	10	**Account Maintenance Certificate (5-Marks)** • Full Marks are given if Original Certificate is provided for bank/financial institution. **Bank Credit Line Certificate (5-Marks)** • 2 Mark are given if the available bank credit line limit is between PKR 400 Million and PKR 500 Million. • 3 Marks are given if the available bank credit line limit is between PKR 500 Million and PKR 600 Million. • 5 Marks are given if the available bank credit line limit is between PKR 600 Million and PKR 700 and above.

b)	Annual Turn Over in last three financial years (FY 2021-22, FY 2022-23 & FY 2023-24)	10	• 3 Mark is given if the average annual turnover for last three years is more than Rs. 300 million and up to Rs. 500 Million. • 5 Marks are given if the average annual turnover for last three years is more than Rs. 500 Million and upto Rs. 700 Million. • 10 Marks are given if average annual turnover for last three years is more than Rs. 700 Million.
c)	Working Capital in last Three financial years (FY 2021-22, FY 2022-23 & FY 2023-24)	5	• 2 Mark is given if the average working capital for last five years is more than Rs. 25 Million and up to Rs. 50 Million. • 3 Marks are given if the average working capital for last five years is more than Rs. 50 Million and up to Rs. 75 Million. • 5 Marks are given if average working capital is more than Rs. 75 Million.
Total Marks Allocated			**25**

Audited Financial Statements for last three years (FY 2021-22, FY 2022-23 & FY 2023-24) carried out by external auditors are mandatory to be submitted.

iv) Personnel Capabilities

Sr. No.	Description	Total Work Experience (Years)	Experience in Similar Works (years)	Marks
1	Project Manager (Electrical / Mechanical Engineer) (01 No.)	25	15	03
2	Professional Electrical Engineer/Electronics Engineer/ Networking Engineer (02 No.)	20	10	03
3	Occupational Health & Safety Manager (01 No.)	15	10	02
4	Electrical Supervisor (02 No.)	10	08	02
Total Marks Allocated				**10**

The Bidder must demonstrate that it has the suitably qualified personnel for the key positions that meet the requirements and will be made available for this Contract as per requirements.

v) Equipment Capabilities

Sr. No.	Description	Minimum Number Required	Marks
1	Cable carrier Roller & Jack	4	1
2	Megger Meter	2	1
3	Generator (25 KVA)	1	1
4	Testing Equipment's (MV Panels, MV Cables, Transformers, DG Sets, Medical Equipment, Telephone, CCTV, Nurse Call System, Access Control System & Fire Alarm)	4	1
5	Standard Tool Kits etc. (Electrical & Electronics)	2	1
Total Marks Allocated			**05**

The Bidder must demonstrate that it has the above-mentioned equipment and will be made available for this Contract as per requirements.

Note: All the above are the minimum requirements. However, the Bidder should have sufficient resources to complete the Project within scheduled time

Bidders Qualification Forms

To establish its qualifications to perform the contract in accordance with Section (Evaluation Criteria and Qualification Forms) the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder.

Form ELI -1.1

Bidder Information Form

Date: _____
Bid Reference No. (if any) and title:
_____
Page_____of_____ pages

Bidder's name
In case of Joint Venture (JV), name of each member:
Bidder's country of registration: *[indicate country of Constitution]*
Bidder's year of incorporation:
Bidder's legal address [in country of registration]:
Bidder's authorized representative information Name: _____ _ Address:_____ Telephone/Fax numbers: _____ E-mail address: _____
1. Attached are copies of original documents, in case of JV, JV agreement, in accordance withSub-Clause IB 3.1.

Form ELI -1.2

Bidder's JV Information Form
(to be completed for each member of Bidder's JV)

Date: _____

Bid Reference No. (if any) and title: _____

Page _____ of _____ pages

Bidder's JV name:
JV member's name:
JV member's country of registration:
JV member's year of constitution:
JV member's legal address in country of constitution:
JV member's authorized representative information Name: _____ Address: _____ Telephone/Fax numbers: _____ E-mail address: _____

Form CON – 1

Pending

Litigation

Bidder's Name: _____
Date: _____
JV Member's Name_____
Bid Reference No. (if any) and title: _____
Page_____of_____pages

Pending Litigation, in accordance with Eligibility and Qualification Criteria			
□ No pending litigation in accordance with Eligibility and Qualification Criteria, Sub-Factor 2.1. □ Pending litigation in accordance with Eligibility and Qualification Criteria, Sub-Factor 2.1 asindicated below.			
Year of dispute	**Amount in dispute (currency)**	**Contract Identification**	**Total Contract Amount (currency), Eq. PKR (exchange rate)**
		Contract Identification: _____ Name of Employer: _____ Address of Employer: _____ Matter in dispute: _____ Party who initiated the dispute: __ Status of dispute: _____	
		Contract Identification: Name of Employer: Address of Employer: Matter in dispute: Party who initiated the dispute: Status of dispute:	

Form FIN – 3.1:

Financial Situation and Performance

Bidder's Name: _____
Date: _____
JV Member's Name_____
Bid Reference No. (if any) and title: _____
Page_____of_____pages

1. Financial data

Type of Financial information in (currency)	**Historic information for last year, (amount in currency, currency, exchange rate*, Eq. PKR)**
Statement of Financial Position (Information from Balance Sheet)	
Total Assets (TA)	
Total Liabilities (TL)	
Total Equity/Net Worth (NW)	
Current Assets (CA)	
Current Liabilities (CL)	
Working Capital (WC)	
Information from Income Statement	
Total Revenue (TR)	
Profits Before Taxes (PBT)	
Cash Flow Information	
Cash Flow from Operating Activities	

*Refer to IB 14.2 for the exchange rate

2. Financial documents

The Bidder and its parties shall provide copies of financial statements for last year pursuant to Eligibility and Qualification Criteria, Sub-factor 3.1. The financial statements shall:

(a) reflect the financial situation of the Bidder or in case of JV member, and not an affiliatedentity (such as parent company or group member).

(b) be independently audited or certified in accordance with local legislation.

(c) be complete, including all notes to the financial statements.

(d) correspond to accounting periods already completed and audited.

☐ Attached are copies of financial statements[1] for the last year required above; and complying withthe requirements

[1] If the most recent set of financial statements is for a period earlier than 12 months from the date of bid, thereason for this should be justified.

Form FIN – 3.2:

Financial Resources

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current commitments, available to meet the total construction cash flow demands of the subject contract or contracts as specified in Eligibility and Qualification Criteria.

No.	Source of financing	Amount (Eq. PKR)
1		
2		
3		

Form FIN – 3.3:

Current Contract Commitments / Works in Progress

Bidders and each member to a JV should provide information on their current commitments onall contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

Current Contract Commitments					
No.	**Name of Contract**	**Employer's Contact Address, Tel, Fax**	**Value of Outstanding Work [Eq. PKR]**	**Estimated Completion Date**	**Average Monthly Invoicing Over Last Six Months [Eq. PKR /month)]**
1					
2					
3					
4					
5					

Form EXP – 1: Experience in Contracts of Similar Size and Nature

Each Bidder or partner of a JV must fill this form.

Fill out one (1) form per contract.

Contract of Similar Size and Nature			
Name of Firm:			
Contract No	**Contract Identification**		
Award Date:		**Completion Date:**	
Total Contract Amount	**in respective currency _____:** **in PKR Equivalent*:**		
If partner in a Joint Venture, specify participation of total contract amount	**Percentage share in Total:** **Corresponding Amount (in PKR):**		
Employer's name **Address** **Telephone number** **Fax number** **E-mail**			
Description of the Similarity in Accordance with Eligibility and Qualification Criteria, Sub-factor 4			

* Converted to PKR at the rate of exchange at the date of contract.

Form PER - 1: Proposed Personnel

The Bidder shall provide the names of suitably qualified personnel to meet the specified requirements stated in Eligibility and Qualification Criteria, Sub-factor 5. The data on their experience should be supplied using the Form below for each candidate.

1.	**Title of Position***
	Name
2.	**Title of Position***
	Name
3.	**Title of Position***
	Name
4.	**Title of Position***
	Name
7.	**Title of Position***
	Name

*As listed in Eligibility and Qualification Criteria, Sub-factor 5.

Form PER - 2: Resume of Proposed Personnel

Position		
Personnel Information	**Name**	**Date of birth**
	Professional qualifications along with PEC registration No. (if applicable):	
	Total Work Experience [Years]:	**Experience in Similar Work [Years]:**
Present Employment	**Name of Employer**	
	Address of Employer	
	Telephone	**Contact (manager / personnel officer)**
	Fax	**E-mail**
	Job title	**Years with present Employer**

Summarize professional experience in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

From	To	Company/Project/Position/Relevant Technical and Management Experience

LETTERS OF
BID AND
SCHEDULES TO BID

LETTER OF TECHNICAL BID

Bid Reference No. _____

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF REMAINING WORKS - CARGO ELEVATOR, DIESEL GENERATOR & ALLIED WORKS, HVAC DUCTING WORK, FM200 AND ELV SYSTEM AT SINDH FORENSIC SCIENCE LABORATORY AT KARACHI

To:
Project Director
Sindh Forensic Science Laboratory at Karachi
Office no. 203, 2nd Floor, Ibrahim Trade Centre, Shara-e-Faisal, Karachi
Ph.: +92 (021) _____

Gentleman,

1. Having examined the Bidding Documents including Instructions to Bidders, Bidding Data, Conditions of Contract, Specifications, Schedules to Bid including Bill of Quantities, Drawings and Addenda Nos._____for the execution ofthe above-named Works, we, the undersigned, offer to execute and complete such Works and remedy any defects therein in conformity with the said Bidding Documents and Addenda.

2. We meet the eligibility requirements in accordance with IB.3.

3. We, including any Subcontractors for any part of the Contract, are not debarred/ blacklisted by the Employer, any Government/Semi Government/Public Department in Pakistan or foreign country, international organizations or other foreign institutions.

4. Our subcontractors or suppliers for any part of the Contract, if any, shall have nationalities from eligible countries, in accordance with IB.4.4.

5. We understand that all the Schedules attached hereto form part of this Bid.

6. As security for due performance of the undertakings and obligations of this Bid, we submit herewith a Bid Security in the amount @2% of Bid amount drawn in your favour or made payable to you and valid for a period of 104 days beginning from the date Bids are opened, inclusive of 14 days beyond Bid validity period (as mentioned at Sr. No. 8 above).

7. We undertake, if our Bid is accepted, to commence the Works and to complete the whole of the Works comprised in the Contract within the time stated in Contract Data.

8. We agree to abide by this Bid (Technical Bid and Price Bid) for the period of 90 days, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

9. Unless and until a formal Agreement is prepared and executed, this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.

10. We do hereby declare that the Bid is made without any collusion, comparison of figures or arrangement with any other Bidder for the Works.

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

12. We undertake that all the information and documents submitted with the Bid are genuine, and in case of incorrect information of fake documents we shall be liable for punitive action under the Applicable Law.

Dated this_____day of_____2025

Signature: _____

in the capacity of_____duly authorized to sign Bids for and on behalf of

_____

(Name of Bidder in Block Capitals)
(Seal)

Address:_____

_____

_____

Witness:

Signature:_____ Name: _____

Address: _____

Occupation:_____

LETTER OF PRICE BID

Bid Reference No. _____

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF REMAINING WORKS - CARGO ELEVATOR, DIESEL GENERATOR & ALLIED WORKS, HVAC DUCTING, FM200 AND ELV SYSTEM AT SINDH FORENSIC SCIENCE LABORATORY AT KARACHI

To:
Project Director
Sindh Forensic Science Laboratory at Karachi
Office no. 203, 2nd Floor, Ibrahim Trade Centre, Shara-e-Faisal, Karachi
Ph.: +92 (021) _____

Gentleman,

1. Having examined the Bidding Documents including Instructions to Bidders, Bidding Data, Conditions of Contract, Specifications, Schedules to Bid including Bill of Quantities, Drawings and Addenda Nos._____for the execution of the above-named Works, we, the undersigned, offer to execute and complete such Worksand remedy any defects therein in conformity with the said Bidding Documents and Addenda for the sum of PKR_____(Pak Rupees_____) or such other sum as may be ascertained in accordance with the said conditions, excluding any discounts offered in item (2) below.

2. The discounts offered and the methodology for their application are:……...

3. We understand that all the Schedules attached hereto form part of this Bid.

4. Unless and until a formal Agreement is prepared and executed, this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.

5. We do hereby declare that the Bid is made without any collusion, comparison of figures or arrangement with any other Bidder for the Works.

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

Dated this_____day of_____2025

Signature: _____

in the capacity of_____duly authorized to sign Bids for and on behalf of

_____

(Name of Bidder in Block Capitals)
(Seal)

Address:_____

Witness:

Signature:

_____

Name: _____

Address: _____

Occupation_____

A-1
Schedule-A to Bid

SCHEDULE OF ADJUSTMENT DATA

Schedule of Cost Indexation

[NOT USED]

Table I. Local Currency (LC) For Bill Nos.____

[NOT USED]

Table II. Foreign Currency (FC) For Bill Nos._

[NOT USED]

Table III. Foreign Currency Requirements

[NOT USED]

Table IV. Summary of Payment Currencies

[NOT USED]

B-1-1
Schedule-B to Bid

BILL OF QUANTITIES/SCHEDULE OF PRICES

A. Preamble

1. For scheduled items, the bidder shall quote percentage above or below on the amount put to bid and given in the summery of cost of estimate.

2. For non-scheduled items, the bidder shall quote his rates in Bill of Quantities /Schedule of Prices**.**

3. The Bill of Quantities /Schedule of Prices shall be read in conjunction with the Conditions of Contract, Specifications and Drawings.

4. The Quantities given in the Bill of Quantities /Schedule of Prices are estimated and provisional quantities and are given to provide a common basis for bidding. The basis for payment will be the actual quantities of work executed and measured by the Contractor and verified by the Engineer and valued at the rates and prices entered in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Engineer may fix as per Contract.

5. The rates and prices quoted in the Bill of Quantities /Schedule of Prices, except insofar as it is otherwise provided under the Contract, include all costs of Contractor's plant, labour, supervision, materials, execution, insurance, profit, taxes and duties, together with all general risks, liabilities and obligations set out or implied in the Contract. Furthermore, all duties, taxes and other levies payable by the Contractor under the Contract, or for any other cause, as on the date 28 days prior to deadline for submission of Bid, shall be included in the rates and prices and the total Bid Price submitted by the Bidder.

6. A rate or price shall be entered against each Non-Scheduled item in the priced Bill of Quantities /Schedule of Prices, whether quantities are stated or not. The cost of items against which the Contractor will have failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.

7. The whole cost of complying with the provisions of the Contract shall be included in the items provided in the Bill of Quantities /Schedule of Prices and where no items are provided, the cost shall be deemed to be distributed among the rates and prices for the other related items of the Works.

8. Complete description of items of works in the Bill of Quantities /Schedule of Prices, general directions, conditions and limitations of works, location and place of works, applicable methods, means to be adopted, type and quality of materials, use of tools, plant, and machinery are not necessarily mentioned in the Bill of Quantities. These shall be referred to in accordance with the Drawings and Technical Specifications.

B-1-2
Schedule-B to Bid

9. For Scheduled Items, Technical Specifications of Sindh Schedule Rates, Government of Sindh (relevant to Schedule of Rates – 2024) shall be applicable. Whereas, for Non-Scheduled Items, Technical Specifications enclosed in Volume-II (Technical Provisions) of the Bidding / Contract Documents shall be applicable. “Ref. Specification Section” indicates the specification section number which as a whole or part (for which the Engineer shall be the sole judge) of these Specifications are to be followed during execution of the item of work in accordance with the applicable drawings.

10. The bidder may ensure himself of the correctness of quantities and application of the individual items of works as per the Drawings, Technical Specifications and Contract Documents.

11. No claim for extra payment will be admissible on account of anticipated profit or variation in overheads expenditure for the works not actually performed nor will any adjustment in the unit rate set forth in the Bill of Quantities be made because of any increase or decrease in the quantities indicated therein.

12. Unless otherwise stated in the text of the Bill of Quantities /Schedule of Prices, the quantities have to be measured and paid in accordance with the Measurement and Payment Clauses given in the relevant Technical Specifications or in accordance with implied meaning of the specifications. Any special method of measurement stated in the text of estimate is limited to the concerned items only.

13. The following abbreviations for the Units have been used in the Bill of Quantities:

Unit	**Abbreviations**
Running foot	Rft.
Square foot	Sft.
Cubic feet	Cft.
Kilogram	Kg.
Metric Ton	M. Ton
Per Number	Each, Number, No.
Lump Sum Job	Job, Lot
Provisional Sum	LS

B-2
Schedule-B to Bid

BILL OF QUANTITIES/SCHEDULE OF PRICES

B. Work Items:

1. The Bill of Quantities contains the following Bills and Schedule

SUMMARY OF COST

- Fire Fighting FM 200 (BOQ Item A-1)
- Energy Monitoring, Diesel Generator & Allied Works (BOQ Codes B-1 & B-2)
- HVAC ducting works (BOQ Code C-1)
- ELV System & Other Works (BOQ Codes D-1 to D-18)
- Cargo Elevator Works (BOQ Code E-1)

2. Bidders shall price the Bill of Quantities in Pak. Rupees (PKR) only.

Establishment of Sindh Forensic Science Laboratory at Karachi

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF
REMAINING WORKS - CARGO ELEVATOR, HVAC DUCTING, DIESEL GENERATOR & ALLIED WORKS, FM200 AND ELV SYSTEM
AT SINDH FORENSIC SCIENCE LABORATORY AT KARACHI

Grand Summary of Bid Price

Sr. #	Works Decription	Total amount (Rs.)
A	Fire Fighting FM-200 System **(BOQ Code A1)**	
B	Energy Monitoring System & Electrical Works (DG Sets, Transformers, UPS, PFI, MV & Synchronizing Panels, HT Cables, Fuel Tanks etc.) **(BOQ Codes B1 + B2)**	
C	HVAC Ducting Works **(BOQ Code C1)**	
D	ELV system & other works **(BOQ Codes D1 to D18)**	
E	Cargo Elevator **(BOQ Code E1)**	
	Grand Total (A+B+C+D+E) (Rs.)	

Bid Price in Words:

_____

_____

Establishment of Sindh Forensic Science Laboratory at Karachi

Summary of Priced Bill of Quantities

Sr. #	Works Decription	Bid Price (Rs.)		
		Schedule Items	Non Schedule Items	Total
		a	b	a+b
A-1	Fire Fighting FM-200 System			
B-1	Energy Monitoring System			
B-2	Electrical Works (DG Sets, Transformers, UPS, PFI, MV & Synchronizing Panels, HT Cables, Fuel Tanks etc.)			
C-1	HVAC Ducting Works			
D-1	Addressable Fire Alarm & Public Address			
D-2	LAN Infrastructure & Internet Bandwith Connection			
D-3	IP Based Surveillance System			
D-4	Access Control System			
D-5	Employees Attendance System			
D-6	Microphone Conferencing System			
D-7	Server & Storage system			
D-8	SIEM Solution			
D-9	Video Conferencing System			
D-10	Wireless Local Area Networking (WLAN)			
D-11	Audio Video System			
D-12	IP Based Surveillance System & PIDS			
D-13	Walkthrough Gates & Baggage Scanning Machine			
D-14	Under Vehicle Surveillance System (UVSS)			
D-15	Integrated Building Management System			
D-16	Disaster Recovery Site (Server, SAN & Software)			
D-17	IP Based PABX and Telephone System			
D-18	Queue Management System			
E-1	Cargo Elevator			

FIRE FIGHTING FM 200
(BOQ Code A-1)

HOME DEPARTMENT GOVERNMENT OF SINDH
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

A-1: FIRE FIGHTING WORKS (FM-200 SYSTEM)
(Additional Works 4th and 5th Floor, Fire Suppresion System and Dry Riser)

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
01	**FM -200 System** **CYLINDERS FILLED WITH FM200 AGENT** Supply and Installation of following cylinders filled with "FM-200" suppression agent at working pressure of 42 bar and test pressure up to 70 bar designed and submiited by the Contractor. **Note: The capacity and quantity of clean agent with cylinders and other BOQ items for FM-200 system is tentative. Prior to installation, Contractor shall submit complete set of calculations on manufacturer's approved software and BOQ for Automatic flooding system and accessories for room/data center size as per site condition for approval of Engineer.**						
i)	**Evidence Vault (16'x18.5'x13.5') Cylinder filled with 266 lb FM200 agent**						
a)	Conventional Single Area Extinguishing Control Panel	Each	1				
b)	Conventional Photoelectric Smoke Detector	Each	2				
c)	Manual pull station	Each	1				
d)	Abort Switch	Each	1				
e)	Zone disable switch	Each	1				
f)	Fire Horn/ strobe	Each	1				
g)	Fire Alarm Bell	Each	1				
h)	FM-200 factory filled and pressurized agent	lbs	266				
i)	61 L Container assembly including bursting disc, cylinder straps, brackets, discharge valve and flexible discharge	Each	2				
j)	Check valve	Each	2				
k)	Main reserve switch	Each	1				
l)	DFIA actuator switch	Each	2				
m)	Low pressure switch	Each	2				
n)	Discharge pressure switch	Each	1				
o)	1 1/2" x 360 degree nozzle	Each	1				
p)	Caution "Do Not Enter" sign	Each	1				
q)	2 cylinders manifold Sch. 40 seamless size 3" complete with brackets and hooks	Each	1				
r)	Wiring for system components with 2 x 1.5 sq.mm fire resistence cable in PVC conduit	Lot	1				
s)	MS schedule 40 seamless high pressure piping including mechanical fitting	Lot	1				
t)	Room Integrity test of enclousers/rooms	Lot	1				

A-1: FIRE FIGHTING WORKS (FM-200 SYSTEM)
(Additional Works 4th and 5th Floor, Fire Suppresion System and Dry Riser)

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
ii)	**Evidence Vault (16.75'x18.5'x13.5') Cylinder filled with 286 lb FM200 agent**						
a)	Conventional Single Area Extinguishing Control Panel	Each	1				
b)	Conventional Photoelectric Smoke Detector	Each	2				
c)	Manual pull station	Each	1				
d)	Abort Switch	Each	1				
e)	Zone disable switch	Each	1				
f)	Fire Horn/ strobe	Each	1				
g)	Fire Alarm Bell	Each	1				
h)	FM-200 factory filled and pressurized agent	lbs	286				
i)	61 L Container assembly including bursting disc, cylinder straps, brackets, discharge valve and flexible discharge	Each	2				
j)	Check valve	Each	2				
k)	Main reserve switch	Each	1				
l)	DFIA actuator switch	Each	2				
m)	Low pressure switch	Each	2				
n)	Discharge pressure switch	Each	1				
o)	1 1/2" x 360 degree nozzle	Each	1				
p)	Caution "Do Not Enter" sign	Each	1				
q)	2 cylinders manifold Sch. 40 seamless size 3" complete with brackets and hooks	Each	1				
r)	Wiring for system components with 2 x 1.5 sq.mm fire resistence cable in PVC conduit	Lot	1				
s)	MS schedule 40 seamless high pressure piping including mechanical fitting	Lot	1				
t)	Room Integrity test of enclousers/rooms	Lot	1				
iii)	**Evidence Vault (17.75'x24.5'x13.5') Cylinder filled with 402 lb FM200 agent**						
a)	Conventional Single Area Extinguishing Control Panel	Each	1				
b)	Conventional Photoelectric Smoke Detector	Each	2				
c)	Manual pull station	Each	1				
d)	Abort Switch	Each	1				
e)	Zone disable switch	Each	1				
f)	Fire Horn/ strobe	Each	1				
g)	Fire Alarm Bell	Each	1				
h)	FM-200 factory filled and pressurized agent	lbs	402				
i)	61 L Container assembly including bursting disc, cylinder straps, brackets, discharge valve and flexible discharge	Each	2				
j)	Check valve	Each	2				
k)	Main reserve switch	Each	1				
l)	DFIA actuator switch	Each	2				
m)	Low pressure switch	Each	2				
n)	Discharge pressure switch	Each	1				
o)	1 1/2" x 360 degree nozzle	Each	1				
p)	Caution "Do Not Enter" sign	Each	1				
q)	2 cylinders manifold Sch. 40 seamless size 3" complete with brackets and hooks	Each	1				
r)	Wiring for system components with 2 x 1.5 sq.mm fire resistence cable in PVC conduit	Lot	1				
s)	MS schedule 40 seamless high pressure piping including mechanical fitting	Lot	1				
t)	Room Integrity test of enclousers/rooms	Lot	1				

A-1: FIRE FIGHTING WORKS (FM-200 SYSTEM)
(Additional Works 4th and 5th Floor, Fire Suppresion System and Dry Riser)

				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
iv)	**Data Center (34.75'x22'x13.5') Cylinder filled with 706 lb FM200 agent**						
a)	Conventional Single Area Extinguishing Control Panel	Each	1				
b)	Conventional Photoelectric Smoke Detector	Each	2				
c)	Manual pull station	Each	1				
d)	Abort Switch	Each	1				
e)	Zone disable switch	Each	1				
f)	Fire Horn/ strobe	Each	1				
g)	Fire Alarm Bell	Each	1				
h)	FM-200 factory filled and pressurized agent	lbs	706				
i)	61 L Container assembly including bursting disc, cylinder straps, brackets, discharge valve and flexible discharge	Each	2				
j)	Check valve	Each	2				
k)	Main reserve switch	Each	1				
l)	DFIA actuator switch	Each	2				
m)	Low pressure switch	Each	2				
n)	Discharge pressure switch	Each	1				
o)	1 1/2" x 360 degree nozzle	Each	1				
p)	Caution "Do Not Enter" sign	Each	1				
q)	2 cylinders manifold Sch. 40 seamless size 3" complete with brackets and hooks	Each	1				
r)	Wiring for system components with 2 x 1.5 sq.mm fire resistence cable in PVC conduit	Lot	1				
s)	MS schedule 40 seamless high pressure piping including mechanical fitting	Lot	1				
t)	Room Integrity test of enclousers/rooms	Lot	1				
02	Electrical works including connection to Zone control Valves, cabling, cable trays, conduiting and related works is in Contractor scope of works.	Lot	1				
03	Relevant civil works required to complete the system including, cutting, patching, repairing, boxing, opening sealing with fire stopping material, plastering etc.	Lot	1				
04	Spare Parts	Lot	1				
05	Overall Testing & Commissioning of complete system	Lot	1				
06	Defect Liability Period	Months	12				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount Carried over to Summary		

BIDDER'S EQUIPMENT DATA

Technical catalogues are required only to substantiate the data provided in these forms. Catalogues of equipment not listed in these forms shall not be submitted and if submitted, will be ignored. Acceptance of Bid will not mean the acceptance of information given in those catalogues.

A. FIRE HOSE CABINETS WITH REEL

1. Make _____
2. Country of Manufacture _____
3. Pressure Rating _____
4. Authorized Distributor in Pakistan _____

B. SPRINKLERS

1. Make _____
2. Country of Manufacture _____
3. Authorized Distributor in Pakistan _____

C. VALVES

1. Make _____
2. Country of Manufacture _____
3. Pressure Rating _____
4. Authorized Distributor in Pakistan _____

D. Gas Suppression system (FM 200 system)

1. Make _____
2. Country of Manufacture _____
3. Authorized Distributor in Pakistan _____

Initials of Signatory to Bid: _____

LIST OF APPROVED MANUFACTURERS FOR ITEMS/ MATERIALS/EQUIPMENT OF FIRE FIGHTING WORKS

The Bidder should note that only Equipment/materials from the following approved manufacturers shall be allowed to be used on this Project provided their products meet the specified requirements.

SR. NO.	EQUIPMENT/ MATERIAL	APPROVED MANUFACTURER/ SUPPLIER	COUNTRY (origin, manufacturing, assembly, testing & supply)
1.	Gas Suppression System	KIDDIE FIKE VIKING SFFECO LIFECO OR APPROVED EQUAL	USA/EUROPE/UAE
2.	Hose Reel & Cabinets	NAFFCO SFEECO LIFECO FIKCO FIRECHIEF OR APPROVED EQUAL	UAE/UK/ PAKISTAN
3.	Sprinklers	TYCO VIKING SHIELD NAFFCO SFFECO LIFECO OR APPROVED EQUAL	JAPAN/USA/UK/ EUROPE/UAE
4.	Valves, Alarm Check Valve Assembly, Zone Control Valve Assembly, Pressure Reducing Valve, Landing Valve Pressure Relief valve, Drain Cocks, Air vents etc.	TYCO VIKING SHIELD LIFECO GALA PEREGRINE OR APPROVED EQUAL	JAPAN/USA/UK/ EUROPE/TURKEY
8.	MS Seamless Pipe	HUFFAZ ECONOSTO BAOLAI OR APPROVED EQUAL	PAKISTAN/CHINA

9.	Hangers / Supports	FISCHER HILTI MUNGO INKA OR APPROVED EQUAL	UK/EUROPE/CHINA
10.	Portable Fire Extinguishers	NAFFCO SFFECO LIFECO OR APPROVED EQUAL	UAE

NOTE 1: ALL EQUIPMENT/MATERIAL MUST BE SUPPLIED FROM AUTHORIZED/SOLE DISTRIBUTORS. MANUFACTURERS AUTHORIZATION CERTIFICATE IN ORIGINAL MUST BE PROVIDED.

NOTE 2: MINIMUM QUALIFICATION CRITERIA REQUIREMENT OF FIREFIGHTING EQUIPMENT MANUFACTURER

For all proposed equipment manufacturer shall meet the minimum following criteria:

- Minimum ten (10) years of international experience for same offered equipment.
- Minimum three (03) years national experience with local authorization representative and after sale service available in Pakistan.
- Compliance with international standards/codes as per Clause S-08 of specifications of firefighting works applicable to relevant equipment.
- High ambient compatibility equipment.
- Most energy efficient equipment/model available in market and offered for the project.
- Testing facilities as per project requirement.
- Verifiable list of minimum five (05) projects in last five (05) years in Pakistan.
- All major parts used inside equipment like pumps, hydrants, valves etc. shall be supplied from the manufacturers' best source available in international market.
- International certificate of performance of proposed equipment/model available as per international standards.

NOTE: ALL EQUIPMENT/MATERIALS OTHER THAN STATED ABOVE SHALL BE SUBJECT TO PRIOR APPROVAL OF THE ENGINEER IN RESPECT OF MAKE & COUNTRY OF ORIGIN.

Initials of Signatory to Bid: _____

Energy Monitoring, Diesel Generator & Allied Works (BOQ Codes B-1 & B-2)

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING

CONSTRUCTION OF MAIN LABORATORY BUILDING

B-1: ENERGY MONITORING SYSTEM

				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	IMPORTANT NOTES (Applicable to all Electrical Items)						
	All electrical items given below shall be read in conjuction with parts of the Specifications and electrical drawings except otherwise indicated.						
	The Electrical Works include design, supply, transportation, installation, testing and commissioning of the following items of works as mentioned in this BOQ (unless specifically stated otherwise) including all material, labour, tools, accessories, related civil works, etc., as required for proper completion of each item as per specifications unless otherwise mentioned. (Any necessary material not mentioned in specifications, electrical drawings and here in this BOQ required for proper installation, testing and commissioning of equipment and materials shall be included in BOQ rates.						
	ENERGY MONITORING SYSTEM						
	Supply and installation of digital energy analysis & metering system including all installation and with all allied accessories complete in all respects as required.						
1	Graphical based digital energy analyzer with active energy class 0.2S, Modbus RS485 based with complete graphical monitoring of current, voltage, P.F, kWH, harmonics on analyzer screen, with all mounting accessories complete in all respects. The analyzer must have a built-in memory of at least 4MB for saving parameters including all required accessories complete in all respect.	Each	100				
2	Gateway/master or data logger device for communication of slave devices with the gateway with all mounting accessories complete in all respects. The gateway must have RJ-45 jack for TCP/IP communication.	Each	4				

B-1: ENERGY MONITORING SYSTEM

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
3	Software for on-line energy analysis & recording including on line values/parameters display on screen complete in all respects.	Each	1				
4	Hardware Comprising of Branded (HP/DELL) rack mounted PC, Core i5 with 8GB RAM, Remote Key board, Remote Mouse, 500GB Hard, High Resolution Graphic card, connecting wires etc. complete in all respects as required.	Each	1				
5	RS-485 cable for loop wiring of analayzer to master device with all allied accessories	Rft	2,000				
6	Cat-VI cable for connecting up of master device to switch and from switch to local computer with all allied accessories.	Rft	700				
7	Testing and Commissioning of complete system as per project specified requirements complete in all respects.	Job	1				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried over to Summary)		

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

B-2: UPS, DG SETS, TRASNFORMERS, PFI & SYNC PANELS ETC,

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	IMPORTANT NOTES (Applicable to all Electrical Items)						
	All electrical items given below shall be read in conjuction with parts of the Specifications and electrical drawings except otherwise indicated. The Electrical Works include design, supply, transportation, installation, testing and commissioning of the following items of works as mentioned in this BOQ (unless specifically stated otherwise) including all material, labour, tools, accessories, related civil works, etc., as required for proper completion of each item as per specifications unless otherwise mentioned. (Any necessary material not mentioned in specifications, electrical drawings and here in this BOQ required for proper installation, testing and commissioning of equipment and materials shall be included in BOQ rates.						
A	**UNINTERUPTED POWER SUPPLY (UPS)**						
	(For LAB Equipment & Data Center)						
1	Supply,installation, testing and commissioning of UPS & Battery System complete with all required accessories etc.The fitting shall be approved by the Engineer. 400 Volts, three phase four wire, 50 Hz, Online double conversion pure sine wave with backfeed protection output Power factor 0.9, advance batteries (backup time 8-10 minutes) management, built in manual maintenance bypass, built in hot sync Brand New UPS including all required accessories.						
(a)	10 kVA	Each	21				
(b)	15 kVA	Each	5				
(c)	45kVA	Each	1				
(d)	120kVA (Data Center)	Each	2				

B-2: UPS, DG SETS, TRASNFORMERS, PFI & SYNC PANELS ETC,				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
2	Supply,installation, testing and commissioning of UPS & Battery System complete with all required accessories etc.The fitting shall be approved by the Engineer. 220 Volts, single phase two wire + earth, 50 Hz, Online double conversion pure sine wave with backfeed protection output Power factor 0.9, advance batteries (backup time 8-10 minutes) management, built in manual maintenance bypass, built in hot sync Brand New UPS including all required accessories.						
(a)	5 kVA	Each	1				
B	**DG SETS**						
3	400 Volts, three phase four wire, 50 Hz skid mounted Brand New Prime power (at 50 C˚) DG set including canopy,Day fuel tank, foundation and all required accessories.						
a)	1250 kVA (for HVAC)	Each	2				
b)	1250 kVA (For Lighting & Small Power)	Each	2				
c)	650 kVA (For Lighting & Small Power)	Each	1				
d)	400 kVA (For Lighting & Small Power)	Each	1				
e)	200 kVA (For Data Centre)	Each	1				
4	AMF/ATS for following DG set including all installation and operational accessories suitable for:						
a)	200 kVA (For Data Centre)	Each	1				

B-2: UPS, DG SETS, TRASNFORMERS, PFI & SYNC PANELS ETC,				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
C	**TRANSFORMER**						
5	Supply of 3000 kVA, 11/0.415 kV Pad mounted Dry type Transformer without HT and LT compartments including foundation, installation material and all required allied accessories, as per WAPDA standards and practice (for Lighting Small Power, LAB Equipment, Lifts & Fire Fighting Pumps). As per IEC Specs.	Each	1				
6	Supply of 2500 kVA, 11/0.415 kV Pad mounted Dry type Transformer without HT and LT compartments including foundation, installation material and all required allied accessories, as per WAPDA standards and practice (for HVAC) As per IEC Specs.	Each	1				

B-2: UPS, DG SETS, TRASNFORMERS, PFI & SYNC PANELS ETC,				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
D	**POWER FACTOR IMPROVEMENT PANEL (PFI)**						
7	14 SWG steel sheet clad IP 44 colour RAL 7032 powder coated power factor improvement panel (PFI) including Cu busbar, heavy duty incoming and outgoing circuit breaker to capacitor, magnetic contactors, continuous digital p.f controller, on & off pushbuttons etc. complete with all components/ accessories as per specifications.						
	MATERIAL						
(a)	**PFI PANEL (1100 kVAR)** - 12 steps with continuous digital power factor and capacitor controller - 01 No. Hand/OFF/Auto selector switch - 10 Nos. 100 kVAR capacitor - 02 Nos. 50 kVAR capacitor - 10 Nos. 460A Magnetic contactor - 02 Nos. 210A Magnetic contactor 06 Nos. 320A MCCB, TP (Adj.) RC=36 kA Circuit breaker 06 Nos. 160A MCCB, TP (Adj.) RC=36 kA Circuit breaker - 12 No. Indication light (1 for each magnetic contactor) - 24 No. Push Buttons (ON/OFF) - 12 No. Auxiliary contractor (NO/NC) - 01 Panel light with limit switch - All other accessories required for completion of quality work - 14 SWG powder painted 01-cubicle with electrolytic copper bus bar with electrical grade PVC mountings 3 for each, nuts, bolts and washers, control MCB etc. - Contractor shall submit the genuine certificate from the manufacturer/authorized agent clear by indicating the project name make/model/rating of MCCB, MCB, magnetic contactors, terminal blocks and voltmeters/ammeter alongwith warranties.	**Each**	**1**				

B-2: UPS, DG SETS, TRASNFORMERS, PFI & SYNC PANELS ETC,				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	MATERIAL						
(b)	**PFI PANEL (900 kVAR)**	**Each**	**1**				
-	12 steps with continuous digital power factor and capacitor controller						
-	01 No. Hand/OFF/Auto selector switch						
-	06 Nos. 100 kVAR capacitor						
-	06 Nos. 50 kVAR capacitor						
	06 Nos. 460A Magnetic contactor						
	06 Nos 210A Magnetic contactor						
-	2 Nos. 63A MCCB, TP (Adj.) RC=25 kA Circuit breaker						
	12 Nos. 100A MCCB, TP (Adj.) RC=36 kA Circuit breaker						
-	14 No. Indication light (1 for each magnetic contactor)						
-	28 No. Push Buttons (ON/OFF)						
-	14 No. Auxiliary contractor (NO/NC)						
-	01 Panel light with limit switch						
-	All other accessories required for completion of quality work						
-	14 SWG powder painted 01-cubicle with electrolytic copper bus bar with electrical grade PVC mountings 3 for each, nuts, bolts and washers, control MCB etc.						
-	Contractor shall submit the genuine certificate from the manufacturer/authorized agent clear by indicating the project name make/model/rating of MCCB, MCB, magnetic contactors, terminal blocks and voltmeters/ammeter alongwith warranties.						

B-2: UPS, DG SETS, TRASNFORMERS, PFI & SYNC PANELS ETC,				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
E	SYNCHRONIZING PANEL						
8	14 SWG All panels shall be factory built assemblies, have an angle iron frame cladded with 3.2mm (min) steel sheet enclosure having high quality powder coated paint (color RAL 7032). Synchronous panel(s) complete in all aspects including but not limited to Synchronous/Auto start module, all accessories/ components/control wiring including control cable ACB/MCCB, MCB, Bus Couplers/suitable electro mechanical interlocking (as applicable), meters, indication lights, timers, relays, CTs, push buttons, indication lights, terminal blocks, buzzers cable glands at bottom for cable entry of appropriate sizes, door, locking arrangement etc. and all other accessories as defined herein, mentioned in relevant specification or drawings as per approval of the Engineer. Bus bars shall be of 400V, TP, 7000 Amp TPN&E. Panel board shall be mounted on foundation/base frame with all installation and operational accessories as per site specifications, drawings or as directed by the Engineer. Synchronous modules shall be selected for proper operation of the system/generator(s) in parallel duly interconnected and rated for given load. 03 Nos. of DG Set Synchronization module make Deep Sea UK model DSE 8610 & 02 Nos. 2000A TP Motorized ACB RC 66 kA 02 Nos. 1250A TP Motorized ACB RC 66 kA (for 04 Nos. DG Sets) & 01 No. normal supply synchronization module make Deep Sea UK model DSE 8660 & 01 No. 6300A TP Motorized ACB RC 100kA (for 01 No. Transformer) along with self seeking power supply model DSE-160 make Deep Sea UK including UVT and shunt trip etc. and . complete in all respect.	Each	1				

B-2: UPS, DG SETS, TRASNFORMERS, PFI & SYNC PANELS ETC,				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
9	14 SWG All panels shall be factory built assemblies, have an angle iron frame cladded with 3.2mm (min) steel sheet enclosure having high quality powder coated paint (color RAL 7032). Synchronous panel(s) complete in all aspects including but not limited to Synchronous/Auto start module, all accessories/ components/control wiring including control cable ACB/MCCB, MCB, Bus Couplers/suitable electro mechanical interlocking (as applicable), meters, indication lights, timers, relays, CTs, push buttons, indication lights, terminal blocks, buzzers cable glands at bottom for cable entry of appropriate sizes, door, locking arrangement etc. and all other accessories as defined herein, mentioned in relevant specification or drawings as per approval of the Engineer. Bus bars shall be of 400V, TP, 4000 Amp TPN&E. Panel board shall be mounted on foundation/base frame with all installation and operational accessories as per site specifications, drawings or as directed by the Engineer. Synchronous modules shall be selected for proper operation of the system/generator(s) in parallel duly interconnected and rated for given load. 02 Nos. of DG Set Synchronization module make Deep Sea UK model DSE 8610 & 02 Nos. 2000A TP ACB Motorized RC 66 kA (for 02 Nos. DG Sets) & 01 No. normal supply synchronization module make Deep Sea UK model DSE 8660 & 01 No. 5000A TP ACB Motorized RC 100kA (for 01 No. Transformer) along with self seeking power supply model DSE-160 make Deep Sea UK including UVT and shunt trip etc. and . complete in all respect.	Each	1				

B-2: UPS, DG SETS, TRASNFORMERS, PFI & SYNC PANELS ETC,				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
F	**MV PANEL**						
10	Providing and fixing 11kV transformer protection/owner panel with 3 Nos. of 11 kV 630 amps drawable type VCBs along with CTs, VTs, capacitor trip unit over current and earth fault protection relays, selector switches indication lamp, push button and all accessories required for satisfactory operation of the system as per Single Line Diagram complete in all respects.	Each	3				
11	Providing and fixing 11kV industrial panel as per Wapda specification P-44.97.	Each	1				
12	Providing and fixing 11kV consumer panel as per Wapda specification P-44.96.	Each	1				
13	Providing and fixing 11kV Auto changeover panel VCB Switchboard as per Wapda specification.	Each	1				
G	**HT CABLE AND TERMINATION KIT**						
14	HT cable 1-core 240 Sq.mm XLPE/PVC/AWA/PVC cable with aluminium conductor voltage grade:8.7/15 kV	Rft	3,500				
15	Providing and fixing/installation indoor 1-core 240 Sq.mm, 11KV, XLPE, heat shrink termination Kit complete in all respect as required.	Each	30				
16	Providing and fixing/installation outdoor 1-core 240 Sq.mm, 11KV, XLPE, heat shrink termination Kit complete in all respect as required.	Each	6				

B-2: UPS, DG SETS, TRASNFORMERS, PFI & SYNC PANELS ETC,				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
H	**FUEL TANK**						
17	Under Ground Bulk Fuel Tank, 30000 liters capacity, 6mm MS sheet along with automation pumps control, control panel, cables Fuel transfer pumps, automation System with necessary piping for 04 Nos. 1250kVA, 02Nos. 650kVA & 01 Nos 200kVA DG sets including all civil works complete in all respect.	Each	1				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary)		

UN-INTERRUPTIBLE POWER SUPPLY SYSTEMS (UPS) - TECHNICAL DATA REQUIRED

Brand Name	
Country of Manufacture	
Model-Series	
UPS Rating	KVA
INPUT	
Input phases	
Nominal voltage	V
Maximum input tolerance for non-intervention of battery	V
Nominal frequency	Hz
Power factor	
BY-PASS	
Maximum acceptable tolerance for mains switching	%
Configuration of voltage tolerance (from control panel)	%
Maximum frequency tolerance accepted for switching	%
Configuration of configurable frequency tolerance (from control panel)	%
Switching time in Line Interactive mode (by-pass/inverter and vice versa)	ms
Protection against mains back feed	
OVERLOADS ON BY-PASS (xIn)	
1s	
10ms	
Efficiency	%
BATTERY(SLA)	
Type of battery	
Intervention time (mains failure)	
Nominal power supplied	KW
Compensation of battery voltage with temperature	mV/°C per element
OUTPUT	
Number of phases	
Nominal voltage	V
Field of regulation of the phase/neutral voltage (from control panel)	V
Wave form	
Frequency	Hz
Operation as frequency converter	
Operation as back-up unit (load powered only if mains absent)	
Current peak factor (as per standard EN50091-3)	

1

UN-INTERRUPTIBLE POWER SUPPLY SYSTEMS (UPS) - TECHNICAL DATA REQUIRED

Nominal power (VA)	KVA
Nominal power (W)	KW
Static variation	%
Dynamic variation (with load impact from 0 to 100%)	%
Output frequency variation with mains absent	%
Output frequency variation with mains present	%
Output frequency variation (from mimic panel)	%
Voltage distortion (linear load)	%
Voltage distortion (non-linear load)	%

OVERLOAD TIMES (from inverter)

100%< Load <110%	hrs
110%< Load <125%	min
125%< Load <150%	min
Short circuit current (t<0.5 sec.)	%
Short circuit current (phase/neutral)	In
Short circuit current (phase/phase)	/
Inverter efficiency	%

VARIOUS

AC/AC efficiency (double conversion mode)	%
AC/AC efficiency (Line interactive mode) 98%	
Maximum permanent operating temperature	°C
Humidity	%

PROTECTIONS

Noise	dB(A)

DIMENSIONS

Mechanical characteristics	Shielded metal cabinet with applied plastic front
Level of protection	IP
Cables input	Front, from the bottom
Cooling	Forced ventilation, with speed variable according to load

SCHEDULE OF TECHNICAL DATA TO BE FILLED IN FOR EACH TYPE/RATING OF DRY TYPE TRANSFORMER

Description	Data To Be Submitted (By Bidder)	
	3000 kVA	2500 kVA
Type of Transformer: • Cast resin dry type (CRT) • Vacuum pressure impregnated (VPI)		
Winding Material		
HV Supply System		
Number of phases		
System neutral		
Fault level (nominal design)		
LV Supply System: • No-load voltage • Number of phases		
Ambient temperature (50° C)		
Altitude		
Supply Frequency (HZ)		
Winding connection		
Vector group		
Impedance		
No load loss		
Load loss		
HV Tapping (% of no-loads volts)		
Method of cooling		
Secondary voltage at: • Full load • No load		
Rated Voltage		
Rated High Voltage		
Rated Low Voltage		

1

Description	Data To Be Submitted (By Bidder)	
	3000 kVA	2500 kVA
Voltage Regulation		
Overload capacity under forced air cooling system		
HV Insulation Level: • Impulse KV Peak • Power Frequency (KV RMS)		
Paint finish color		
HV conductor and type		
LV conductor and type		
Indoor or outdoor		
Installation/space limitations		
Coil material (HV)		
Coil material (LV)		
Average Winding Temp. rise (HV/LV)		
Basic Impulse Level		
Insulation Class: • HV Winding • LV Winding		
Compliance with the IEC requirements		
Noise Level		
Enclosure degree of protection		
Environmental, Climatic, Fire classes		
Partial discharge value		
Total Harmonic distortion		
Basic Impulse Withstand Level (BIL)		
K-Factor		
Seismic requirements compliance		

SCHEDULE OF TECHNICAL DATA TO BE FILLED IN FOR EACH TYPE/RATING OF DG SETS

Sr. No	Data Required	Data To Be Submitted (By Bidder)
1	**ENGINE**	
	Manufacturer's Name/ Country of Origin	
	Model	
	Maximum Engine Rating -(BHP)	
	Continuous Output Rating -(BHP)	
	Derating Factor:	
	(i) For Altitude of 1250 meters above MSL	
	(ii) For inlet Air Temperature of	
	(iii) Others if any	
	Engine Rating at Site-(BHP)	
	Period of maximum Engine Rating in Hours	
	Operating speed-RPM	
	Piston Speed (m/s)	
	Bore & Stroke-Inches	
	No. of cylinders	
	Arrangement of Cylinders (in line/v)	
	Engine Capacity-Cu.in./cc	
	Compression Ratio	
	Coupling Type	
	Mounting Arrangement	

1

Sr. No	Data Required	Data To Be Submitted (By Bidder)
	Cooling System	
	Ignition System	
	Overload Capability	
	Governor Type And Make	
	Efficiency at 0.85 pf % At 25% of rated load At 50% of rated load At 75% of rated load At 100% of rated load	_ _ _ _
	Lube oil consumption (Liters/hr) At 0% of rated load At 25% of rated load At 50% of rated load At 75% of rated load At 100% of rated load	_ _ _ _ _
	Specific Fuel consumption (Liters/hr) At 0% of rated load At 25% of rated load At 50% of rated load At 75% of rated load At 100% of rated load	_ _ _ _ _
	Lubrication system nominal oil pressure (kg/cm^2)	
	Lubrication system minimum oil pressure (kg/cm^2)	
	Lubricating oil Sump capacity (ltr.)	
	Radiator capacity (ltr.)	
	Compusion air intake at 50 Hz (cm^3)	
	Engine heat radiation (K cal/min.)	
	Exhaust gas temperature at manifold, deg C.	
	Exhaust gas rate (ltr/sec.)	
	Starting system voltage (v)	
	Specific Feature if any	

Sr. No	Data Required	Data To Be Submitted (By Bidder)
2	**GENERATOR**	
	Manufacturer's Name/ Country of Origin	
	Model	
	Design Rating -(KVA)	
	Continuous Output Rating -(KVA)	
	Net electrical Output at site -(KVA)	
	Rated Voltage-volts	
	Power Factor	
	Speed-(RPM)	
	Frequency-Hz	
	Type designation	
	Time delay	
	(i) Manufacturer	
	(ii) Type designation	
	Timing	
	(i) Manufacturer	
	(ii) Type designation	
	Tripping	
	Insulation class	
	Stator Rotor Exciter	
	Overload Capability %	
	Harmonic Content %	
	Temperature Rise ^{0}C	
	Voltage Regulation	

Sr. No	Data Required	Data To Be Submitted (By Bidder)
	Type	
	Regulator	
	Regulation %	
	Voltage Dip %	
	Response Time (Sec)	
	Frequency Regulation -%	
	Deviation Factor %	
	Efficiency at 0.85 pf % At 25% of rated load At 50% of rated load At 75% of rated load At 100% of rated load	
	Exciter	
	Type	
	Rated Voltage-Volts	
	Full load current -Amps.	
	Radio Frequency Interference	
	Telephone interference factor	
	Charge Capacity	
	Batteries Type Rating-AH	
	Noise output level of Set (dB) At 0 % of rated load At 25% of rated load At 50% of rated load At 75% of rated load At 100% of rated load	

Sr. No	Data Required	Data To Be Submitted (By Bidder)
	De-rating Factor	
	For Altitude of given height in meters above MSL of the site of installation	
	For ambient temperature of	
	others ,if any	
	Special features, if any	
3	**ACCESSORIES**	
	(Contractor to state if any of the following accessories will be supplied - give details) Crankcase Heater Automatic water Makeup System Ducting for radiator Exhaust System Silencer Fuel Day Tank Fuel Piping System Fuel pump	
	Meters/Gauges to indicate: Engine speed in rpm Lube oil Pressure in Bars Lube oil temperature in ^{0} C Engine running hours in hrs. Battery Charging current in Amps.	
	Alarm/Indicating lamps for Engine Overspeed Low lube oil pressure High engine water temperature Over voltage Under voltage Short-circuit/tripping of main circuit breaker low fuel level	

Sr. No	Data Required	Data To Be Submitted (By Bidder)
	High fuel level Winding temperature high Over cranking Low oil level High oil level Charging alternator failure	
	Safety devices for instantaneous shut down due to Engine over speed Low lube oil pressure High water temperature shut down	
	Safety devices for adjustable delayed shut down, through shut down timer, due to: Over voltage Short circuit/tripping of main circuit breaker Low fuel oil in tank Winding temperature high	

Note: The above Data to be filled for each rating of DG Set and to be submitted with the bid.

LIST OF MANUFACTURERS/BRANDS OF EQUIPMENT / MATERIALS FOR ELECTRICAL WORKS

The list of manufacturers/suppliers of different equipment/materials given as below in order to establish conformance of the product in accordance with the relevant International Standards as applicable. The contractor shall provide and fix the equipment/materials of brand new & superior quality as indicated below or approved equivalent as per approval of the Engineer/Employer.

SR. NO.	EQUIPMENT/ MATERIALS	MANUFACTURERS/BRANDS
1	PVC Conduit & Accessories	Beta, Popular, Dadex, Dura Flow, Jadda, Galco, Civic
2	MV Cables	As per Client approved list (Newage, Fast, Pakistan cable)
3	LV Cables	As per Client approved list (Newage, Fast, Pakistan & Allied cable)
4	Steel/G.I Conduit & Accessories	Hilall Industries, IIL & Jamal Pipe
5	Cable Trays & Accessories	Ashraf Industries, Green T&D, South Asia Bilal Switchgear, Electroline & EZEE Engg
6	MCCBs, MCB Magnetic Contactors	Schneider (France), ABB (Italy), Legrand (France), Terasaki (Japan), Panasonic Green power (Japan) & Telemecanique
7	ACBs, ELCBs	ABB (Italy), Siemens (Germany), Schneider (France) Terasaki (Japan) & Legrand (France)
8	UPS	Borri, APC, GE and Siemens
9	Transformers (11/0.415 kV)	a) (Oil Immersed) PEL, Elmetec & Transfopower b) (Dry Type) ABB, Legrand & Schneider, PEL-IMEFY
10	11 kV Panels	Elmetec, Siemens, PEMPAK, Schneider, ABB, ERCON and PEL
11	MV Termination/Straight	Jointing kit, Raychem (Germany), 3M (USA) and Elastimold (Egypt)
12	Programmable Logic Controllers	Schneider Electric, Siemens and ABB
13	Photoelectric EE Switches	National Photoelectric EE Switches
14	Relays and Timers	Finder (Italy) and Inter (Turkey)

LIST OF MANUFACTURERS/BRANDS OF EQUIPMENT / MATERIALS FOR ELECTRICAL WORKS

SR. NO.	EQUIPMENT/ MATERIALS	MANUFACTURERS/BRANDS
15	LV Changeover Switch	Socomec (France), ABB (France/Germany), LG, Elcontrol (Itlay) and Entus
16	Capacitors	Amber, Nokian and Ducati
17	PFI Relays	Nokian (Finland) and Entes (turkey)
18	Voltmeter/Ammeters	Circulor (Italy), Revalco (Italy), Inter (Turkey), and Entes (Turkey)
19	Current Transformer/Voltage Transformer	Metalx, Revalco (Italy) and Fico
20	Back Boxes, Pull boxes etc.	Bosch, Hero, Legrand, Clipsal, Hussain & Co., MK, Schneider & ABB
21	Data Network Accessories and Communication Cable Trays	3 M, Amps, Crosheind, Baynet, APC & Panduit.
22	Fire Alarm and Detection System	Bosch, GST, Honeywell, Novec, Fike, Foton, Cooper, Cooper Menvier
23	Fans	Climax, Pak, Millat, Royal, SK, Voldam & Yunas
24	Selector Switches/ Push Button/Switches/Switch socket	Kraus & Naimer, ABB, Legrand, Clipsal Revalco (Italy) Bosch, Crosehind, MK, Phillips (Signify)
25	Indication Lamps	Legrand (France), Breter (Italy) ABB and Telemecanique
26	Low Voltage Panel, MCC & ACP	SA, ERCON, Elmetec, MESI, PEL, Green T&D Bilal Switchgear, PEMPAK Hussain & Co, Baber Brother's, Power Engineer's
27*.	DG Sets	Cater Pillar (UK), FG Wilson, Siemens (German), SDMO, Mitsubishi (Japan) and Cummins power
27(a).	Diesel Engine	Volvo (Sweden), Perkins (UK), Cummins (UK), FG Wilson (UK) Mitsubishi (Japan), John Deere (France) & Cater Pillar (UK)
27(b).	Alternator	Siemens (German), Newage/Stamford/Cummins (UK), Lorrey Sommer (France) and Cater Pillar(UK)

LIST OF MANUFACTURERS/BRANDS OF EQUIPMENT / MATERIALS FOR ELECTRICAL WORKS

SR. NO.	EQUIPMENT/ MATERIALS	MANUFACTURERS/BRANDS
28	MV/LV Bus Tie Duct	Legrand, ABB, Schneider, GE & Siemens
29	Terminal Blocks	Legrand (France), ABB, Phoenix & Cabour
30	Road Light Poles	Jamal Pipe Industries, Bashir Pipe Industries and Lion Steel Industries
31	Lighting	GE, Philips, Thorn, Pierelite, Osram, NVC, Cooper lighting, EAE &Ledvance
32	Earthing and Grounding Accessories	Furse, Erico, Aplicaciones Technologicas & Wallis
33	Lightning Protection System	Aplicaciones Technologicas, Furse & Erico
34	Earthing System	Aplicaciones Technologicas, Furse, Erico & Wallis
35	Energy Monitoring System	Schneider, ABB, GE, Janitza & Siemens
36	Emergency lighting System	Olympia, Legrand, Schneider, Philips, Cooper & GE.
37	2-Core Fire Resistance Cable	Prysmian, Cavicel (Italy), Belden, Firecell & 2M KABLO (FireKab) Turkey

*The DG Set offered shall have the engine and alternator of the brand as mentioned under item 27(a) & 27(b).

HVAC Ducting
(BOQ Code C-1)

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

H-1: HVAC DUCTING WORKS - 4th & 5th FLOORS

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
1	**Supply and installation of Sheet Metal Ducting and insulation as per schedule specification & drawings including all accessories & fitting complete in all respect.**						
a)	**G.I. Sheet Metal**						
a-1)	U.S GAUGE 26 Sheet Metal	SFT	2,500				
a-2)	U.S GAUGE 24 Sheet Metal	SFT	30,000				
a-3)	U.S GAUGE 22 Sheet Metal	SFT	28,000				
b)	Insulation for Indoor Supply/Return Air Duct concealed to Vision as per Insulation Schedule Given in Specifications	SFT	60,000				
c)	Acoustic Liner on Supply Air Ducts and Sheet Metal Air Plenums	SFT	1,000				
d)	G.I. Sheet Metal with Powder Epoxy Resin Coating, Anti Rust & Anti Fungal Paint						
d-1)	U.S GAUGE 26 Sheet Metal	SFT	500				
d-2)	U.S GAUGE 24 Sheet Metal	SFT	12,000				
d-3)	U.S GAUGE 22 Sheet Metal	SFT	10,000				
2	**Supply & installation of Volume Control Dampers, transportation, unloading, storage, lifting, and fixing at locations including, accessories, all taxes and duties.**						
a)	GI Sheet Volume Control Dampers	SFT	900				
b)	SS Sheet Volume Control Dampers	SFT	150				
3	**Supply and installation of air devices for complete system as per specification & drawing with all accessories and fitting complete in all respect.**						
a)	CODE A: Supply Air Four Way Square/Rectangular Face Ceiling Diffusers	SFT	400				
b)	CODE B: Return & Exhaust Air Four Way Square/Rectangular Face Ceiling Diffusers	SFT	400				
4	**Relevant civil works required to complete the system including, equipment foundations, cutting, patching, repairing, opening, sealing etc. complete an all respect.**	LOT	1				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount		

FORENSIC SCIENCE LABORATORY, KARACHI
HOME DEPARTMENT, GOVERNMENT OF SINDH

HEATING VENTILATION & AIR CONDITIONING (HVAC) WORKS

LIST OF RECOMMENDED MANUFACTURERS & SUPPLIERS

It is to noted by the Bidder that, the equipment/materials from the following approved/recommended manufacturers/suppliers or approved equivalent source shall be allowed to be utilized on subject project provided that the proposed products meet the specified requirements of the documents. All equipment/materials shall be supplied from the Manufacturer's own Factory/Plant/Facility.

No.	Equipment & Materials	Recommended Manufacturers & Suppliers	Country (Origin, Manufacturing, Assembling, Testing & Supply)
1	Duct Insulation & Sound Liners	AFICO IZOCAM KIMMCO KNAUF ARMAFLEX DURKFLEX AEROFOAM ODE	KUWAIT, SAUDI ARABIA, EUROPE, TURKEY, USA,UAE
2	Galvanized Iron Sheets	PAKISTAN STEEL MILLS INTERNATIONAL STEELS LIMITED	PAKISTAN, SOUTH AFRICA, NEWZEALAND
3	Air Inlets & Outlets	MEHRAN THERMAC EAP AIR CONTROL STEELCRAFT SA INDUSTRIES AEROTECH PAK PRIEMER	PAKISTAN
4	Fasteners, Hanger Rods, Rawal Plugs, Supports, Channels etc.	FISHER HILTI DIAMOND WALRAVEN SIKLA SPIT INKA MUNGO NORM INDEX	AS PER MANUFACTURER'S FACILITY
5	White Glue	FOSTER MOVILITH	USA, WEST EUROPE
6	Duct Sealants	DOW CORNING ZAHBIA	USA, TURKEY, PAKISTAN

NOTES

1. All equipment/materials must be supplied from authorized representatives and or sole distributors of the Manufacturers in Pakistan.
2. Manufacturer's authorization certificate must be provided.
3. Compliance to the aforementioned country (origin, manufacturing, assembling, testing & supply) for offered/supplied equipment/materials is mandatory.Approved equivalent may only be acceptable from same country of origion.
4. In case of any approved equivalent brand other than the aforementioned recommended manufacturers/suppliers, the Bidder shall submit the following additional information for prequalification purpose with the technical bid;

a. Compliance of equipment/materials parts and their origin as mentioned in the specifications.
b. Compliance statement of specifications from the manufacturer of the equipment/materials.
c. Comparison of each part/system of the proposed brand with one of the aforementioned recommended brands including quality certificates and test reports etc.
e. Approved equivalent brands shall be clearly mentioned in the technical bid by the Bidder including the aforesaid information complete in all respect.Approved equivalent bid will only be acceptable as alternate bid after acceptance of technical bid.

ELV system & other works (BOQ Codes D-1 to D-18)

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

D1 - ADDRESSABLE FIRE ALARM & PUBIC ADDRESS SYSTEM

				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	C. COMMUNICATION WORKS						
	ADDRESSABLE FIRE ALARM SYSTEM						
	Ref. Sec.No. 8331						
01-1C	1" dia PVC conduit installed concealed including all installation and mounting accessories.	Rft.	24,259				
01-2C	1.5 sq.mm fire resistant 2 core (120 min) LSZH enhanced cable complying BS5839, BS6387, and EN50200 in already installed conduit.	Rft.	20,269				
01-3C	2.5. sq.mm fire resistant 2 core (120 min) LSZH enhanced cable complying BS5839, BS6387, and EN50200, in already installed conduit.	Rft.	4,128				
01-4C	Intelligent addressable multi optical and heat detector complete with built-in isolator, base including all mounting and installation accessories.	No.	685				
01-5C	Intelligent addressable heat detector complete with built-in isolator, base including all mounting and installation accessories.	No.	47				
01-6C	Addressable manual call point including built-in isolator module including all mounting and installation accessories.	No.	54				
01-7C	Addressable loop powered audio visual sounder with built-in isolator including all mounting and installation accessories.	No.	55				
01-8C	Addressable loop powered control / output module with manufaturer's recommended interfacing cable including all mounting and installation accessories.	No.	20				

D1 - ADDRESSABLE FIRE ALARM & PUBIC ADDRESS SYSTEM				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
01-9C	Addressable loop powered monitor / input module with manufaturer's recommended interfacing cable including all mounting and installation accessories.	No.	11				
01-10C	Supply and installation of mobile application for remote viewing of fire alarm system. Complete in all respect.	Job.	1				
01-11C	Addressable loop powered end to end type optical beam smoke detector including all mouting and installation accessories.	No.	3				
01-12C	8 loops fire alarm control panel expandable upto 10 loops complete with network card (RS485/RS-232/IP), LAN interface, fire alarm software, interfacing with public address, access control system, lifts etc. maintenance free batteries, battery charger, power supply, printer including any other essential interconnecting equipment as required. Complete in all respect.	Job.	1				
	VOICE EVACUATION / PUBLIC ADDRESS SYSTEM						
	Ref. Sec.No. 8341						
01-13C	1" dia PVC conduit installed concealed including all installation and mounting accessories.	Rft.	14,554				
01-14C	6 Watts Recessed Wide Dispersion Ceiling speaker with matching transformer including all installation and mounting accessories	No.	395				
01-15C	15 Watts IP-65 Horn Loudspeaker with matching transformer, wall mounted bracket including all installation and mounting accessories.	No.	8				
01-16C	15 Watts IP-66 rated (Suitable for outdoor conditions) Horn Loudspeaker with matching transformer, wall mounted bracket including all installation and mounting accessories.	No.	2				

D1 - ADDRESSABLE FIRE ALARM & PUBIC ADDRESS SYSTEM				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
01-17C	Wiring of speakers from PA Rack with 2.5 sq.mm fire resistant 2 core (120 min) LSZH enhanced cable / manufacturer's recommended cable in already installed conduit.	Rft.	14,554				
01-18C	System Manager with required Matrix bus with 25% spare capacity having microprocessor modular matrix, MP3 / USB / CD / SD / Tuner format playing card, input card, output card, LAN connectivity, dedicated duty amplifier for each zone, auto standby amplifier of highest wattage, automatic switchover, line fault detection system, manufacturer's recommended emergency power supply backup with DC power output, trickle charging, with suitable manufacturer's recommended backup batteries as required, PA software, SPL calculations, interfacing with fire alarm system including any other essential interconnecting equipment and cabling as required with all installation and mounting accessories for satisfactory operation of the entire public address & voice evacuation system. Complete in all respect.	Job.	1				
01-19C	Remote Microphone with keypad for required number of zones, fault monitoring including patch cord, all installation and mounting accessories. Complete in all respect.	No.	1				
01-20C	One Port CAT-6A STP RJ45 telecommunication wall outlet with sheet steel back box and face plate including all installation accessories.	No.	2				
01-21C	Wiring from Remote Microphone upto PA Rack as shown on drawing at Basement Floor with CAT-6A STP LSZH cable / manufacturer's recommended cable in already installed conduit / cable tray.	Rft.	330				

D1 - ADDRESSABLE FIRE ALARM & PUBIC ADDRESS SYSTEM				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
01-22C	42U (800 mm x 600 mm) 19" Rack, plexiglass door including Hoops, side management, cable trays, fans for cooling and exhaust, required Power Distribution Unit and power sockets, Power cabling in PVC concealed conduit from UDB to relevant Rack. Complete in all respect.	No.	1				
01-23C	Detail engineering designing of Public Address System for Prayer area (Male + Female), having mixer amplifier, headgear and unidirectional dynamic microphone with floor stand, microphone socket outlet, required number of speakers, including any other essential interconnecting equipment, cabling, conduiting, rack as required. Complete in all respect.	Job.	1				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carreid Over to Summary)		

HOME DEPARTMENT GOVERNMENT OF SINDH
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

D-2 - LAN INFRASTRUCTURE & INTERNET BANDWIDTH CONNECTION (CSR Items) **Priced BOQ**

Item No.	CSR 2024 Item No.	Description	Unit	Qty	Rate (Rs.)	Amount (Rs.)
		PVC Pipe 1.5 inch				
1	Item No. 138, Pg. 86, Vol III, Part VI 2024	PVC pipe 1.5 inch (10 ft. per length) with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	ft. / APA	30,000	52	1,560,000
		PVC Pipe 1“				
2	Item No. 136, Pg. 86, Vol III, Part VI 2024	PVC pipe 1 inch (10 ft. per length) with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	ft. / APA	40,000	24	960,000
		UPVC Pipe 2”				
3	CHAPTER-IV & V WATER SERVICES (INTERNAL / EXTERNAL) Pg 86	UPVC pipe 2 inch (10 ft. per length) with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	ft. / APA	1,000	669	669,330
					Total Cost of Works Carried Over to Summary Rs.	**3,189,330**
					Add/Deduct ___% Premium/Discount on Scheduled Item	
					Total Cost of CSR Item Carried over to Summary	

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

D-2 - LAN INFRASTRUCTURE & INTERNET BANDWIDTH CONNECTION (NSR Items)

				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
	Core Switch Layer 3						
1	Stackable fixed configuration manageable Layer 3 Switch, Switching capacity: 1.92 Tbit/sec or higher, Optical interface: 24SFP Plus+ ports, 4QSFP Plus ports, (Optical interface 10GE ports, 40GE ports, and 100GE ports card are supported), dual power supply, power cable, hot swappable redundant fans , Multi-layer switching and enhanced routing capability, Support of RIP, OSPF, DHCP snooping, Support ARP entries of 140K minimum, Support multicast traffic, Software based fault tolerance, MAC Address entries should be minimum 200K, QoS and Filtering, Multi-layer switching and enhanced routing capability, Support multiple VLANs, Security features: 802.1x, Access Control Lists (ACLs), SNMP enabled, remote monitoring, Telnet support, Web based management interface with complete installation, configuration, testing and minimum one year comprehensive warranty	No.	2				
	Distribution Switch						
2	Stackable fixed configuration manageable Layer 3 Switch having switching capacity: 680 Gbps or higher, 26 x 10 Gig SFP plus Ports, 2 x 40G QSFP Ports, 1 slot for future expansion, support 802.1X authentication, Multilayer Quality of Service (QoS), support multicast traffic, MAC address authentication entries should be 200K or more, Support minimum 140K ARP entries, support multiple VLANs, ACL, Redundant power supplies hot swappable, Redundant fans, Power cable, SNMP enabled, Web based management interface, NAT, telnet with complete installation, configuration, testing and minimum one year comprehensive warranty	No.	2				
	TOR Switch						
3	Fixed configuration manageable Data Centre switch, 48 x 25 Gbps SFP Ports, 4 x 40 Gbps QSFP uplink port, redundant power supply and fans, power supply, SNMP enabled, Supports Bidirectional Forwarding Detection (BFD) with a detection interval of 1 ms or higher, Web based management interface with complete installation, configuration, testing and minimum one year comprehensive warranty	No.	2				

D-2 - LAN INFRASTRUCTURE & INTERNET BANDWIDTH CONNECTION (NSR Items)				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
	Next Generation Fire Wall						
4	Next generation Firewall with throughput of 15 Gbps or higher with SFP and RJ45 port, dual redundant power supply, usb operator or console port, capable of web filtering, application control, IPs, URL filtering, anti pam, anti-malware Must Have Minimum 3.6 Gbps NGFW Throughput IMIX (FW + SA + IPS) Must Have Minimum 4 Gbps Threat Protection Throughput IMIX (FW + SA + IPS + Antivirus) IPsec VPN throughput ≥ 15 Gbit/s Must Have Unrestricted Concurrent User Must Have Minimum 1TB Storage Capacity Must Have Minimum 6 x 1G Ethernet Interfaces & 4x10G SFP+ Interfaces. Must Include Intrusion Prevention System (IPS), Anti-Virus & Anti-Malware, Email Security Protection, Web Filtering, Application Control, Bandwidth Management, Policy-based routing, RIP, OSPF, BGP, and IS-IS, Minimum 100 Concurrent Users for SSL VPN 3 Year Complete Security Features License 3 Year Software Upgrade & 24x7 Technical Support	No.	2				
	48 Port Layer-2 Manageable Network Switch						
5	Fixed configuration manageable layer 2 switch, 48 x 10/100/1000Base T Ports, 4 x 10 GE SFP ports for SFP based uplink connectivity over fibre optics, Forwarding speed: 132 Mpps, Switching capacity 176 Gbps or higher, 2 GB RAM, support 802.1X authentication, MAC address authentication, support multiple VLANs, ACL, with complete installation, testing and minimum one year comprehensive warranty. Warranty Period shall start after signing of Handing Over/Taking Over Certificate.	No.	19				
	24 Port Layer-2 Manageable Network Switch						
6	Fixed configuration manageable layer-2 switch, 24 x 10/100/1000Base T Ports, 4 x 10 GE SFP ports for SFP based uplink connectivity over fibre optics, Forwarding speed: 96 Mpps, Switching capacity 128 Gbps, 2 GB RAM, support 802.1X authentication, MAC address authentication, support multiple VLANs, ACL, with complete installation, testing and minimum one year comprehensive warranty. Warranty Period shall start after signing of Handing Over/Taking Over Certificate.	No.	8				
	40G QSFP+ Modules						
7	40 Gigabit QSFP+ Module Single Mode LX/LH with standard manufacturer warranty and complete in all aspects	No.	12				

D-2 - LAN INFRASTRUCTURE & INTERNET BANDWIDTH CONNECTION (NSR Items)				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	25G QSFP Modules						
8	25 Gigabit QSFP Module Single Mode LX/LH with standard manufacturer warranty and complete in all aspects	No.	75				
	10G SFP+ Modules						
9	10 Gigabit SFP Module Single Mode LX/LH with standard manufacturer warranty and complete in all aspects	No.	140				
	1G SFP Modules						
10	1 Gigabit SFP Module Single Mode LX/LH with standard manufacturer warranty and complete in all aspects	No.	16				
	24 Core Single Mode Fiber Optics cable						
11	24 Core Fiber Optic Cable Single Mode with Steel Tape armoured cable with complete installation, testing and minimum 20 years comprehensive warranty and complete in all aspects Fiber Optic Cable Fusion Splicing Single Mode with complete installation and complete in all aspects	ft. / APA	6,000				
	25 Gigabit fiber istack cable						
12	istack fiber cable for the connectivity of TOR switches with servers with standard manufacturer warranty and complete in all aspects	No.	96				
	Direct attached Copper Cable						
13	Direct attached Copper Cable with module for 10G connectivity with standard manufacturer warranty and complete in all aspects	No.	20				
	48 Ports Rack Mountable Fiber Optic Patch Panel						
14	48 Ports Rack Mountable Fiber Optic Patch Panel OFDF Loaded capacity of 24 Nos. of LC Duplex Coupler with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	No.	2				
	24 Ports Rack Mountable Fiber Optic Patch Panel						
15	24 Ports Rack Mountable Fiber Optic Patch Panel OFDF Loaded capacity of 12 Nos. of LC Duplex Coupler with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	No.	4				
	12 Ports Rack Mountable Fiber Optic Patch Panel						
16	12 Ports Rack Mountable Fiber Optic Patch Panel OFDF Loaded capacity of 06 Nos. of LC Duplex Coupler with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	No.	21				

D-2 - LAN INFRASTRUCTURE & INTERNET BANDWIDTH CONNECTION (NSR Items)				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	Fiber Patch Cord						
17	Fiber Patch Cord Duplex LC- LC Patch Cord, LSZH, 1 Meters with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	No.	320				
	Pigtails						
18	Pigtail 1 meter, Single mode with complete installation and complete in all aspects	No.	600				
	UTP Patch Panel 48 Port						
19	Patch Panel 48 Port Cat-6 loaded with Unshielded IO with complete installation, testing and minimum one year comprehensive warranty	No.	19				
	UTP Patch Panel 24 Port						
20	Patch Panel 24 Port Cat-6 loaded with Unshielded IO with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	No.	8				
	42U Floor Standing Rack						
21	42U Floor Standing Rack glass door with 04 Fans and PDU 8 port, Lock and keys with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	No.	4				
	27U Floor Standing Rack						
22	27U Floor Standing Rack glass door with 02 Fans and PDU 4 port, Lock and keys with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	No.	7				
	Cat-6 A 4 Pair U/UTP Cable						
23	Cat-6 A 4 Pair U/UTP Cable, 305M Box with complete installation, testing and minimum 20 years comprehensive warranty and complete in all aspects	ft. / APA	140,000				
	Front Cable Manager 1U						
24	Rack mountable Front Cable Manager of size 1U with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	No.	29				
	UTP Patch Cord Cat-6 A of size 1 Meter						
25	UTP Patch Cord Cat-6 A U/UTP of size 1 Meter with complete installation, testing and minimum 20 years comprehensive warranty and complete in all aspects	No.	820				
	UTP Patch Cord Cat-6 AU/UTP of size 3 Meter						
26	UTP Patch Cord Cat-6 A U/UTP of size 3 Meter with complete installation, testing and minimum 20 years comprehensive warranty and complete in all aspects	No.	765				
	Face Plate Shuttered Duplex with Cat-6 Tool Less Keystone Jack Unshielded & Back box						
27	Face Plate Shuttered Duplex with Cat-6 Tool Less Keystone Jack Unshielded & Back box with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	No.	150				

D-2 - LAN INFRASTRUCTURE & INTERNET BANDWIDTH CONNECTION (NSR Items)				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	Face Plate Shuttered Simplex with Cat-6 Tool Less Keystone Jack Unshielded & Back box						
28	Face Plate Shuttered Simplex with Cat-6 Tool Less Keystone Jack Unshielded & Back box with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	No.	465				
	Flexible Pipe						
32	Flexible pipe with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	ft. / APA	1800				
	Cable Tray 2 feet						
33	Cable tray 2 feet wide of 16AWG, MS Powder Coated perforated with covers and complete in all aspects	ft. / APA	5,000				
	Cable Tray 1feet						
34	Cable tray 1 feet wide of 16AWG, MS Powder Coated perforated with covers and complete in all aspects	ft. / APA	4,000				
	Cable Ladder						
35	Width 300mm Cable Ladder 16AWG, MS Powder Coated perforated with covers and complete in all aspects	ft. / APA	1,500				
	UPS 6KVA with standard battery backup						
36	UPS 6 KVA with standard dry battery backup with minimum one year comprehensive warranty and complete in all aspects	No.	2				
	UPS 3KVA with standard battery backup						
37	UPS 3KVA with standard battery backup with minimum one year comprehensive warranty and complete in all aspects	No.	13				
	Outdoor soft digging						
38	3 Feet Digging, Backfilling and Civil Work for Fiber Optic and Electric Cabling and complete in all aspects	ft / APA	500				
	Outdoor hard digging						
39	3 Feet Digging, Backfilling and Civil Work for Fiber Optic and Electric Cabling and complete in all aspects	ft / APA	200				
	RJ 45 Connectors						
40	RJ 45 connectors for UTP Cable with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	No.	1,640				
	Cable tags and labelling						
41	Polyethylene Cable tags with labelling with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	Job / APA	1				

D-2 - LAN INFRASTRUCTURE & INTERNET BANDWIDTH CONNECTION (NSR Items)				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
	Earthing						
42	Earthing in complete aspects with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	Job / APA	1				
	Man Hole						
43	Man Holes (2'x2'x3' from inside) with minimum 2'6" diameter opening lid with complete installation & testing and with standard manufacturer warranty and complete in all aspects	No.	3				
	UTP Cable testing						
44	Fluke testing of UTP cabling infrastructure and complete in all aspects	per point / APA	1,300				
	Fiber Testing						
45	OTDR Fiber cabling infrastructure testing and complete in all aspects	per point / APA	301				
	Splicing						
46	Fiber Optic Cable Fusion Splicing Single Mode with complete installation and complete in all aspects	No.	40				
	12U Wall Mounted Rack						
47	12U Wall Mounted Rack glass door with 01 Fan and PDU 4 port, Lock and keys with complete installation, testing and minimum one year comprehensive warranty and complete in all aspects	No.	4				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities))		

HOME DEPARTMENT GOVERNMENT OF SINDH
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

D-3 - IP BASED SURVEILLANCE SYSTEM - CSR Items **Priced Bill of Qantities**

Item No.	CSR 2024 Item No.	Description	Unit	Qty	Rate (Rs.)	Amount (Rs.)
		C. COMMUNICATION				
		IP based Surveillance System				
		PVC Pipe 1″				
1	Item No. 136Pg. 86, Vol III, Part VI 2024	PVC Pipe 1″ along with pipe bracket, solvent and installation charges and with standard manufacturer warranty	ft.	4,000	24.0	96,000
					Total (Rs.)	**96,000**
					Total Cost of Schedules Items Rs.	
					Add/Deduct ___% Premium/Discount on Scheduled Item	
					Total Cost of CSR Item (Carried over to Summary)	

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

D-3 - IP BASED SURVEILLANCE SYSTEM (NSR Items)

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	C. COMMUNICATION						
	IP based Surveillance System						
	Camera & Allied Equipment Specifications						
	Indoor Fixed Dome Camera Type I						
1	Full HD IP based PoE Indoor Dome camera with 4 Mega Pixel resolution (2560 × 1440), minimum built-in IR distance at least 30 meter or more, 25/30 fps@ full HD, 2.8 -12 mm lens, H.264/H.265 compression, WDR, Back light Compensation (BLC), 10/100/1000 M Ethernet, RJ45 Port, Motion Detection, Built in web server, ONVIF support, IP 67 rating, Operating Temperature -10°C to +55°C with junction box size 4x4 and complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	18				
	Indoor Fixed Dome Camera Type II						
2	Full HD IP based PoE Indoor Dome camera with 4 Mega Pixel resolution (2560 × 1440), minimum built-in IR distance at least 30 meter or more, 25/30 fps@ full HD, 2.8 mm-12 mm lens, H.264/H.265 compression, WDR, Back light Compensation (BLC), 10/100/1000 M Ethernet, RJ45 Port, Motion Detection, Built in web server, ONVIF support, IP 67 rating, Operating Temperature -10°C to +55°C with junction box size 4x4 and complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	243				
	Indoor Bullet Camera Type III						
3	Full HD IP based PoE Indoor Bullet camera with 4 Mega Pixel resolution (2560 × 1440), minimum built-in IR distance at least 50 meter or more, 25/30 fps@ full HD, 2.8 mm fixed lens, H.264/H.265 compression, WDR, Back light Compensation (BLC), 10/100/1000 M Ethernet, RJ45 Port, Motion Detection, Built in web server, ONVIF support, IP 67 rating, Operating Temperature -10°C to +55°C with junction box size 4x4 and complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	26				

D-3 - IP BASED SURVEILLANCE SYSTEM (NSR Items)				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
	Indoor Bullet Camera Type IV						
4	Full HD IP based PoE Indoor Bullet camera with 4 Mega Pixel resolution (2560 × 1440), minimum built-in IR distance at least 50 meter or more, 25/30 fps@ full HD, 2.8 mm fixed lens, H.264/H.265 compression, WDR, Back light Compensation (BLC), 10/100/1000 M Ethernet, RJ45 Port, Motion Detection, Built in web server, ONVIF support, IP 67 rating, Operating Temperature -10°C to +55°C with junction box size 4x4 and complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	53				
	PTZ Camera Type V						
5	IP Based PTZ Camera with 4 Mega Pixel resolution (2560 × 1440), minimum built-in IR distance 200 meter, 40 X or more optical Zoom, Pan Range: 360º, Tilt Range: Between -10° to 90°, 500 presets or more, H.264 and H.265 video/audio compression, WDR, Back light Compensation (BLC), High Light Compensation (HLC), Motion detection, Video tampering, Network disconnection, Automatic Gain Control (AGC), audio detection, Auto tracking, Privacy masking up to 20 areas or more, Weather proof IP 66 rated, ONVIF support, Operating Temperature -10°C to +60°C with junction box size 6x4 and power adapter, complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	2				
	Embedded Video Storage						
6	Minimum 128 Channel IP cameras input, H.265, H.264, MJPEG compression, upto 16 TB HDD SATA Hot Swappable with RAID 5 configuration, Record Mode: Auto Record, Manual Record, Search Video Detection, alarm triggered recording, Intelligent Event, Video Analytics, Web viewer support, Search mode: Date/event/time, Redundant power, 2 USB port, HDMI port, 2 10/100/1000 Mbps Ethernet ports, supports HD video management including live video display, PTZ control, camera cycling, and video wall, support intrusion detection, tripwire crossing detection, loitering detection, fast movement detection, ONVIF support, with complete installation, configuration and testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	5				

D-3 - IP BASED SURVEILLANCE SYSTEM (NSR Items)				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	Video wall of Matrix 7x3						
7	55" 3.5mm bezel-to-bezel LCD/LED panel, 500 cd/m², Contrast: 1200:1, Input: VGA×1, DVI×1, HDMI×1, RS232×1, USB×1, wall-mounted, Complete wall mount installation along with cabling and accessories with complete installation, and with minimum one-year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	1				
	Video Wall Controller						
8	Modular Multi-screen Controller 4U or higher, Video output through High-definition Multimedia Interface (HDMI) ports, Output 4K supported for all channels, , Microprocessor Embedded LINUX, Support 20 Slots for I/O cards or higher, Support video wall splicing with loaded 16 Inputs built-in HDMI and 22 Outputs HDMI, BNC, 2 X RJ-45 ports (10/100/1000M), RS232 ports for console and control, 1 RS485 port, 2 USB2.0, 1 USB3.0. Redundant power, with complete installation, configuration and testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side	No.	1				
	Core Switch						
9	Fixed configuration manageable layer-2+/3 12 port switch for connectivity over RJ45 interface with Rack Mount Kit, 12*10GE SFP+ports, 2*40 QSFP+ ports, redundant fans, redundant power supplies, 4GB RAM, power cable, installation, configuration & testing with standard manufacturer warranty	No.	1				
	Distribution / Aggregation Switch						
10	Fixed configuration manageable layer-2/3 switch with Rack Mount Kit, 24*GE SFP port interface, 10G 2 Ports for uplink connectivity (SFP + interface), 2GB RAM, redundant power supllies, power cable, installation, configuration & testing with standard manufacturer warranty	No.	1				
	48 Port PoE Switch						
11	Fixed configuration PoE enabled manageable layer-2 switch with Rack Mount Kit, 48-Ports 10/100/1000 Mbps RJ-45 interface for camera connectivity over UTP, 2 dual 1G Ports for uplink connectivity (SFP Interface), 802.3af compliant built-in power supply, support power budget of 380W or more, 2 GB RAM, power cable, installation, configuration & testing with standard manufacturer warranty	No.	8				

D-3 - IP BASED SURVEILLANCE SYSTEM (NSR Items)				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	24 Port PoE Switch						
12	Fixed configuration PoE enabled manageable layer-2 switch with Rack Mount Kit, 24-Ports 10/100/1000 Mbps RJ-45 interface for camera connectivity over UTP, 2 dual 1G Ports for uplink connectivity (SFP Interface), 802.3af compliant built-in power supply, support 400W power budget, 2 GB RAM, power cable, installation, configuration & testing with standard manufacturer warranty	No.	9				
	Single mode Fiber Optics cable						
13	8 Core Fiber Optic Cable Single Mode with Steel Tape armored cable with complete installation, testing and minimum 20 years comprehensive warranty	ft.	8,000				
	12 Ports Rack Mountable Fiber Optic Patch Panel						
14	12 Ports Rack Mountable Fiber Optic Patch Panel OFDF Loaded capacity of 06 Nos. of LC Duplex Coupler with complete installation, testing and minimum one year comprehensive warranty	No.	11				
	24 Ports Rack Mountable Fiber Optic Patch Panel						
15	24 Ports Rack Mountable Fiber Optic Patch Panel OFDF Loaded capacity of 12 Nos. of LC Duplex Coupler with complete installation, testing and minimum one year comprehensive warranty	No.	3				
	Fiber Patch Cord						
16	Fiber Patch Cord Duplex LC- LC Patch Cord, LSZH, 1 Meters with complete installation, testing and minimum one year comprehensive warranty	No.	122				
	pigtails						
17	Pigtail 1 meter, Single mode with complete installation	No.	212				
	Splicing						
18	Fiber Optic Cable Fusion Splicing Single Mode with complete installation	No.	212				
	10 SFP Module						
19	10 Gigabit SFP Module Single Mode LX/LH with standard manufacturer warranty	No.	28				
	Dual SFP module						
20	1 Gigabit dual SFP Module Single Mode LX/LH with standard manufacturer warranty	No.	34				
	Cat-6 4 Pair U/UTP Cable						
21	Cat-6 4 Pair U/UTP Cable with complete installation, testing and minimum 20 years comprehensive warranty	ft.	64,000				
	UTP Patch Panel 48 Port						
22	UTP 48-Port Patch Panel with 48 I/O, complete with rear cable management and all accessories, installation and testing, standard manufacturer warranty	No.	8				

D-3 - IP BASED SURVEILLANCE SYSTEM (NSR Items)				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
	UTP Patch Panel 24 Port						
23	UTP 24-Port Patch Panel with 24 I/O, complete with rear cable management and all accessories, installation and testing, standard manufacturer warranty	No.	9				
	Front Cable Manager 1U						
24	Rack mountable Front Cable Manager of size 1U with complete installation, testing and minimum one year comprehensive warranty	No.	19				
	42U Floor Standing Rack						
25	42U Floor Standing Rack glass door with 04 Fans and PDU 8 port, Lock and keys with complete installation, testing and minimum one year comprehensive warranty	No.	1				
	12 U Floor Standing Rack						
26	12 U Floor Standing Rack glass door with 02 Fans and PDU 4 port, Lock and keys with complete installation, testing and minimum one year comprehensive warranty	No.	12				
	UPS 6KVA						
27	Power capacity: 6000 VA with 0.95 or higher Power Factor, Should supply clean, uninterrupted power to the critical loads and meet the specifications, Input voltage: 220 VAC, Output voltage: 220 VAC, pure sine wave, Rack Mountable, online double conversion technology or later, with Inverter and filter providing protection from sags, surges and brownouts, Built in surge protection and line conditioning , Must provide at least 20 minutes backup at full load of 6000 VA, Recharge time less than 6 hours, Maintenance free dry batteries, Serial or USB port for communication, 10/100 Mbps, RJ-45 port for LAN connectivity, Status LED indicator, Audible alarm, Plug and Play, UPS monitoring software, Network management through TCP/IP protocol, Automatic shutdown of non–attendant system, UPS can be connected in parallel and redundant up to multiple units even different power rating, Automatic battery test, Provide cold start functionality to enable power up without mains power supply present, Protection against battery deep discharge with complete installation, configuration & testing and one year comprehensive warranty	No.	1				

D-3 - IP BASED SURVEILLANCE SYSTEM (NSR Items)				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	UPS 1KVA						
28	Power capacity: 1000 VA with 0.95 or higher Power Factor, Should supply clean, uninterrupted power to the critical loads and meet the specifications, Input voltage: 220 VAC, Output voltage: 220 VAC, pure sine wave, Rack Mountable, online double conversion technology or later, with Inverter and filter providing protection from sags, surges and brownouts, Built in surge protection and line conditioning , Must provide at least 20 minutes backup at full load of 1000 VA, Recharge time less than 6 hours, Maintenance free dry batteries, Serial or USB port for communication, 10/100 Mbps, RJ-45 port for LAN connectivity, Status LED indicator, Audible alarm, Plug and Play, UPS monitoring software, Network management through TCP/IP protocol, Automatic shutdown of non–attendant system, UPS can be connected in parallel and redundant up to multiple units even different power rating, Automatic battery test, Provide cold start functionality to enable power up without mains power supply present, Protection against battery deep discharge with complete installation, configuration & testing and one year comprehensive warranty	No.	12				
	UTP Patch Cord 1m						
29	UTP Patch Cord Cat-6 U/UTP of size 1 Meter with complete installation, testing and minimum 20 years comprehensive warranty	No.	450				
	HDMI Cable						
30	10 meter HDMI cable	No.	35				
	Video Monitoring station						
31	PC for Live Monitoring and Recording Playback from NVR; Intel 8th Gen Core-i7 3.40Ghz or above, 6MB Cache, 2GB Dedicated NVidia Graphic Card, 8GB DDR4 RAM, 256GB SSD, Gigabit Ethernet, Keyboard, Mouse, with complete installation, configuration & testing and with standard manufacturer warranty	No.	9				
	Key Board Controller						
32	Joystick to Control PTZ Speed Dome with installation & testing and one year comprehensive warranty	No.	1				
	Pole 4 ft						
33	4 ft. pole with arm, galvanized and concrete base with complete installation and manufacturer warranty	No.	2				
	Flexible Pipe						
35	Flexible pipe for cable termination	ft.	1,000				

D-3 - IP BASED SURVEILLANCE SYSTEM (NSR Items)				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
	PVC Pipe 2"						
36	HD Pipe 2" for outdoor digging along with bracket, solvent and installation charges and with standard manufacturer warranty	ft.	3,000				
	UTP Cable testing						
37	Fluke testing of UTP cabling infrastructure	Job	1				
	Fiber Testing						
38	OTDR Fiber cabling infrastructure testing	Job	1				
	RJ 45 Connectors						
39	RJ 45 connectors for UTP Cable	No.	1,090				
	Cable tags and labelling						
40	Polyethylene Cable tags with labelling	Job	1				
	Power Cabling						
41	2.5 core power cabling along boundary wall and internal connectivity	ft.	2,000				
	UTP PATCH CORD 1m						
42	UTP Patch Cord Cat-6 U/UTP of size 1 Meter with complete installation, testing and minimum 20 years comprehensive warranty	No.	168				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities)		

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

D-4 - ACCESS CONTROL SYSTEM

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	C. COMMUNICATION						
	Access Control System						
	IP Based Biometric + RFID Reader						
1	IP Based Biometric + RFID Color 2.4¨ or higher LCD Touch Screen Card Reader, function and navigation keys, Store Finger Print Templates of 2000 users or more, Transactions: 50,000 or more, Image Resolution: 500 dpi or higher High quality scratch resistance optical sensor, Response time: < 2 sec, Verification modes: Fingerprint, Card, Operation mode: card only, finger only, card + finger, Standard Connectivity: TCP/IP and high speed USB 2.0, FAR/FRR: < 0.001 %/0.1 %, Prominent audio & visual indication for acceptance/rejection of valid/invalid user, Facility to create different Authority Levels for Supervisor/Administrator/User on the device , There should be a facility to verify card or Finger before admin login, Reader shall flash LED and emit a short beep indicating that a card was read , Employee Name/Employee code number should be displayed on the LCD screen along with Access granted, The reader should function in standalone mode when network fails , If any person is trying to open the device an alarm should be raised , Reader should be able to detect the Fake Fingerprints when placed on the sensor. It should accept only live fingerprint and should not read the fake fingerprints made of any chemical composition such as Rubber, Silicon, Gel, Paper, Thin film etc., Provision for setting the time of all machines from a single location to maintain uniform time in all locations, The connectivity of the devices should be detected remotely from remote machine, should have inbuilt capability for online firmware up gradation, Wall mounted, Built in Battery Backup, Temperature: 0 degree C to 50 degree C with complete installation, configuration & testing and with one year comprehensive warranty minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	153				

D-4 - ACCESS CONTROL SYSTEM

				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
	Access Control Software						
2	Web Based Interface, Record entry and exit events, Generate reports (for the specific areas, department, date, etc.), facility to block certain employees access to certain areas due to some reason, Opening and closing of the doors should be possible from PC, Wiegand, Serial, door setting can be configured through access control software, Provision to export reports in Excel, PDF, CSV formats to integrate with any third party software	No.	2				
	Single Leaf EM Lock						
3	Surface Mount Electromagnetic Lock with built in magnetic read switch, U/ L/ Z brackets based on the site conditions , EM lock should be suitable for surface mount on single leaf doors, Input Voltage 12 V, Tensile force range: 120k g±8 %	No.	56				
	Double Leaf EM Lock						
4	Surface Mount Electromagnetic Lock with built in magnetic read switch, U/ L/ Z brackets based on the site conditions , EM lock should be suitable for surface mount on double leaf doors, Input Voltage 12 V, Tensile force range: 120k g±8 %	No.	97				
	Exit Button						
5	Exit button from inside for each identified access location room doors for door release, Switch should make of Stainless steel or better material, Maximum Current: 2A , 12/24V DC or better	No.	153				
	Electric cable						
6	Electric Cable 3/29 2 Core with laying	ft	6500				
	Proximity Cards						
7	EM/Mifare cards with printing	No.	1050				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities)		

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

D-5 - EMPLOYEE ATTEDANCE SYSTEM

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	C. COMMUNICATION						
	Employee Attendance System						
	IP Based Biometric + RFID Reader						
1	IP Based Biometric + RFID Color 2.4¨ or higher LCD Touch Screen Card Reader, function and navigation keys, Store Finger Print Templates of 2000 users or more, Transactions: 50,000 or more, Image Resolution: 500 dpi or higher High quality scratch resistance optical sensor, Response time: < 2 sec, Verification modes: Fingerprint, Card, Operation mode: card only, finger only, card + finger, Standard Connectivity: TCP/IP and high speed USB 2.0, FAR/FRR: < 0.001 %/0.1 %, Prominent audio & visual indication for acceptance/rejection of valid/invalid user, Facility to create different Authority Levels for Supervisor/Administrator/User on the device, There should be a facility to verify card or Finger before admin login, Reader shall flash LED and emit a short beep indicating that a card was read , Employee Name/Employee code number should be displayed on the LCD screen along with Access granted, The reader should function and record attendance even in standalone mode when network fails , If any person is trying to open the device an alarm should be raised , Reader should be able to detect the Fake Fingerprints when placed on the sensor. It should accept only live fingerprint and should not read the fake fingerprints made of any chemical composition such as Rubber, Silicon, Gel, Paper, Thin film etc., Provision for setting the time of all machines from a single location to maintain uniform time in all locations, The connectivity of the devices should be detected remotely from remote machine, should have inbuilt capability for online firmware up gradation , Wall mounted, Built in Battery Backup, Temperature: 0 degree C to 50 degree C with complete installation, configuration & testing and with one year comprehensive warranty minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	2				

D-5 - EMPLOYEE ATTEDANCE SYSTEM				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	Attendance Software						
2	Web Based Interface, Record employees detail (Employee Name, Employee ID, Photo Image, Department, Designation, Date of joining etc.), Record fingerprint templates, Record arrival and departure events, Record overtime of employees, Record daily late arrivals, Record early departure, Record daily absentees, Record casual, sick & earned leaves, Record extraordinary leaves, Create schedules (Gazetted holidays, etc.), Provision for advance entry of leaves (casual, earned, extraordinary, Capable to store, match and search for the registered fingerprint templates in the database, Generate reports (for the specific person, department, date, late comers, punctual employees, daily, weekly and monthly attendance, employee check-in and check-out log, leave status report of employee, etc.), Record Maternity and paternity leaves Support, Provision to export reports in Excel, PDF, CSV formats to integrate with any third party software,	No.	1				
	Attendance Computer						
3	Intel Core i7 11th Generation Processor or higher with 3.4 GHz and above speed, Mother Board: Intel Original, 8 GB DDR4 or higher memory, Hard Disk Drive: 1 TB 7200 RPM, Built in Sound Card , Built-in Network Adapter 10/100/1000 base-T Ethernet card, USB Keyboard, USB Optical Mouse with mouse pad, 6 x USB 3.0 or more I/O interface, 1 x HDMI port, Tower casing having FAN with manufacturer standard power watt, Pre-installed Operating System: Microsoft Windows 10 Pro 64 bit (Licensed), 24" branded LED screen with complete installation, configuration & testing and with minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	1				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities)		

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

D-6 - MICROPHONE CONFERENCING SYSTEM

				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
	C. COMMUNICATION						
	Microphone Conferencing System						
	Central Conrol Unit						
1	Central control unit of the digital sound system/conference system capable to Control 42 delegate units and expandable up to 100 units, Support centralized power supply to delegate units, Single connection between the central unit and the Chairman/delegate units by means of cable, Capable to implement Speech duration period, Support Chairman Unit capability to switch on or off any delegate unit, Speaking time limit can be pre-set for conference units, built in recording software which is capable to record and replay speech of delegate unit and Chairman unit with complete installation & testing and minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	1				
	Flush Mount Chairman Unit						
2	Flush Mount Chairman unit should allow the delegate to talk, request to talk, additional priority button to override all active delegate units, Speaker automatically mutes when the microphone is turned on, Low susceptibility to mobile phone interference, Headphones volume control, Equipped with loud speaker and microphone, provision of headphone port, Centrally Powered and Controlled, Light Indication on Microphone when it is on with complete installation & testing and minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	1				
	Flush Mount Delegate Unit						
3	Flush Mount Delegate unit should allow the delegate to talk, request to talk, Speaker automatically mutes when the microphone is turned on, Low susceptibility to mobile phone interference, Headphones volume control, Equipped with loud speaker and microphone, provision of headphone port, Centrally Powered and Controlled, Light Indication on Microphone when it is on with complete installation & testing and minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	42				
	Fully digital Congress extension unit						
4	Fully digital Congress extension unit (3 congress units outlet)	No.	1				

D-6 - MICROPHONE CONFERENCING SYSTEM

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	30m 6pin extension cable						
5	30m 6pin extension cable with plug and socket for connecting all units with complete installation, testing & commissioning	No.	4				
	5m 6pin extension cable						
6	5m 6pin extension cable with plug and socket for connecting all units with complete installation, testing & commissioning	No.	4				
	UPS 3 KVA						
7	3 KVA UPS with 10 minutes backup with complete installation & testing and minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	1				
	Recording Software						
8	Conference recording software campatible to the system	No.	1				
	Panel						
9	Flush mounted loudspeaker panel	No.	45				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities)		

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

D-7 - SERVER & STORAGE SYSTEM

				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	C. COMMUNICATION						
1	**Primary Site (Server, SAN, Software)**						
	Server	**No.**	**4**				
	2.5" Chassis with up to 12 SAS/SATA Drives, 2 CPU 2 x Intel® Xeon® Gold Processor, 28C/56T or higher, 12 x 64GB RDIMM 2 x 240GB SSD Hot-Plug Dual, Hot-Plug, Fully Redundant Power Supply (1+1), Remote Access Controller supported Dual Port 10/25GbE with SFP module Quad Port 1GbE BASE-T Adapter, PCIe Dual Port 10/25GbE with SFP module, PCIe Rack mountable, Sliding Rails With Cable Management Arm Support and warranty for 1 year						
2	**Storage Solution**	**Complete Job**	**1**				
	The unified storage requirement is divided into Structured and Un-structured data. The overall usable storage shall be minimum 200 TB Raw physical capacity and can be extendable up to 2 petabytes. 30% of the overall usable storage shall be used for structured data. 70% of the overall usable storage shall be used for Un structured data. For Structured & Unstructred Data: Symmetric Active Active Controllers (64 Cores) TLC NVMe SSD drives shall be provided in the Storage Shall support future expansion in NVMe, end to end NVMe, Shoud Support Active-Active Replication for SAN and NAS, The data communication link shall be minimum 25Gb Dual controller offered storage should not have any single point of failure. Hot spare drives must be available for fault tolerance Capacity planning chart must be shared with proposal, Minimum one hot spare drive per disk type must be proposed, Disk backend connectivity must be 25 Gb or Higher, Offered Storage shall support standard protocols FC, FCoE, iSCSI, to provide host connectivity, Redundant Power supply, Rack rails, Must support Microsoft Windows Server 2012 and 2012 R2; Red Hat Enterprise Linux (RHEL) 6 and 7; SUSE Linux Enterprise Server (SLES) 11 and 12; VMware vSphere 5.1, 5.5, and 6.0, The contractor shall provide redundant SAN switches which shall be connected as per the data ports available in Servers and SANs. OM4 LC/LC multi-mode fiber cable patches 5 Meter or any other required Cables for data channel connectivity between Servers and SAN shall be provided accordingly, Support and warranty for 3 years The vendor should provide three (03) years warranty with 24 x 7 x 365 support with 4/8 hours SLA response time by Partner / OEM. The vendor should submit the proof of OEM's logistics center. Microcode of the Storage should be updated/upgraded by OEM. OEM should also have a local office for an emergency contact point. Support and warranty for 1 year						

D-7 - SERVER & STORAGE SYSTEM

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
3	**Backup Solution**	**Complete Job**	**1**				
	Backup of the Production data consists of structured data and un-structured data. For Structure Data: Should be a Purpose-Built Backup Storage with Fast Backup, Recovery and Data Reduction, Active-Active Dual Controllers, Required Usable Capacity 100 TB with RAID up to 300TB before any data reduction Redundant Power Supplies Should have min 4 x 10G ports Should have iSCSI, FC and NFS Protocol support Support Compression & Deduplication Rack Mount Kit, Backup Software: included and must be capable for complete/ detailed backup scheduling and automation Software should provide support for CDP (Continuous Data Protection) functionality to eliminate downtime and minimize data loss for Critical workloads and perform immediate recoveries to a latest state or desired point in time achieving the most stringent RTO and RPO, Should Support Encryption, Secure Snapshots, Backup Software License should be based on 250VMs / 250TB FE Capacity or 100TB BE Capacity Solution should maintain complete control of data protection for ALL virtual, physical workloads by managing both hypervisor-based and agent-based backups natively through one single console Must be capable for: Dedupe / compress, Integrate with Backup solution at DR, Solution must capable for track/maintain the backup logs, Must Support Industry Leading Operating Systems and virtualization platform: Windows, Linux, VMware, Hyper-V, Oracle and SQL, Proposed software can replicate data at DR site Proposed software must capable for Snapshot, Proposed Backup Storage should be compatible with Veeam, Veritas, Commvault and other backup softwares, Support and warranty of hardware for 3 years and 03 Year Support for Backup Software, If Software License is on subscription based, proposed solution must be provided with 03 years Ent level subscription						

D-7 - SERVER & STORAGE SYSTEM

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
5	**Virtualization Platform for Primary Site**						
	Virtualization Management Software (01 Instance)	**No.**	**1**				
	Proposed Solution must provide High Availability / Redundancy Must support to create and manage local Users with Role Based Access and Permission Control Must provide Web Bowser based Management Console Must provide complete visibility and centralized management / control of the Virtualization Platform Must provide capability to scale up to 64 nodes or better **Compute Virtualization (8 Sockets)** Proposed Solution should be highly redundant providing capability for the VMs to restart on another node in case of any Node failure in the Cluster Must provide VM Snapshot capability to revert back to previous point in time in case a failure or system error occurs Must provide VM Clone capability for creating cloned instances from source VM for testing or any other purposes Must provide VM vMotion capability to Live migrate VMs to any nodes in the Cluster without any downtime Must provide the capability to automatically hot-add resources including vCPUs and Memory real-time based on VM contention Must provide automated Resource Scheduling and Load Balancing capability for balanced performance on all nodes across the cluster Must provide Distributed Switch capability to configure and administer switching for the entire Cluster Must provide Hardware Health Check capability to Monitor CPU, Memory, Network Interface Card, Hard Drive and RAID Controller etc It should be 100% Compatible and integratrable with qouted Storage and Backup Solution (Hardware + Software) If Software License is on subscription based, proposed solution must be provided with 03 years Ent level subscription						

D-7 - SERVER & STORAGE SYSTEM

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
6	**Microsoft Windows Server**	**No.**	**APA**				
	Microsoft Windows Server Standard 2022 or latest Core based license						
7	**Microsoft SQL Server**	**No.**	**1**				
	Microsoft SQL Server Standard/Enterprise licenses shall be required for the Forensic software/applications. The 2 core based or higher License is required						
9	**Anti-Virus Solution**	**Complete Package**	**1**				
	Licensed for 3 years Complete Antivirus solution with 24X7 Technical Support including end point protection for: 30 x Server VMs Must Support Centralized Endpoint Installation Via Active Directory Initially 300 x Endpoint Nodes/Users Complete set of Endpoint Protection Features including ransomware protection Must Support Ransomware File Protection Must Support Windows Patching. Must Support USB Security Control for Unauthorized USB Devices Must Support Deep Learning / Artificial Intelligence Malware Detection Must Include Cloud-Sandbox Capability for Realtime Security Detection Reporting and centralized management interface must be full						

1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
2. Sub-Total of Installation, Testing & Commissioning Amount		
3. SST @ 5% on Installation, Testing & Commissioning Amount		
4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities)		

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

D-8 - SIEM SOLUTION

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
1	**SIEM Solution**	**No.**	**1**				
	SIEM Solution with following features: a. Data aggregation b. Security data analytics (reports and dashboards) c. Correlation and security event monitoring d. Forensic analysis e. Incident detection and response f. Real-time event response or alerting console g. Threat intelligence h. User and entity behavior analytics (UEBA) i. The SIEM should be able to perform cross correlation of SOC and NOC analytics j. The SIEM should able to offer Out-of-the-Box Compliance Reports like PCI-DSS, HIPAA, SOX, NERC, FISMA, ISO, GLBA, GPG13, SANS Critical Controls, COBIT, ITIL, ISO 27001, NERC, NIST800-53, NIST800-171, NESA k. Should have 900+ built in rules to detect a wide variety of MITRE techniques l. Should be perpetual virtualized environment solution to cater below requirements: - should be offered in high availibility - 50 devices/servers/systems - 25 x FIM & Performance Agents for Windows and Linux Servers - 2000 EPS m. Data retention and log management for 1 year - 9 months should be compressed/archieved - 3 months reamain available online complete installation and configuration and one year comprehensive warranty The offered SIEM should be from a well-known brand/OEMs and should not be locally or in-house developed.	No.	1				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities)		

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

D-9 - VIDEO CONFERENCING SYSTEM

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	C. COMMUNICATION						
1	**Video Conferencing System**	**No.**	**1**				
	Standard based Video (H.323, H.264 AVC, H.264 High Profile, H.265, H.239 and SIP), Audio pickup range 25 ft or higher, Camera minimum 12x digital zoom, UHD 1080P 120º capture, automatic group framing, automatic speaker framing, presenter mode, Resolution 1080P 1024kbps, minimum 2 x HDMI display supported, Integrated MIC and Speakers, Noise block AI, Built-in operating system, built-in WiFi, IPv4 and IPv6 support, Minimum 1x 1G Ethernet port, Web proxy support, Authenticated access to admin menus, web interface and API, Interoperability, support and license for all other applications including zoom, Microsoft Teams, Skype, Microsoft Lync, Blue Jeans, Dial pad, GoToRoom, Ring Central and same, Intuitive touch interface for easy access to conferencing solution for join call, content sharing, adjust camera and change participant layouts, USB connection to PC or MAC for video calls						
2	**Smart Display**	**No.**	**1**				
	LED UHD Smart Display, Size minimum 75", Display Resolution 3840x2160, Operating System Android, Contrast ratio minimum 5000:1, Refresh rate 60, Integrated Speakers, Internet link 2.4Ghz/5Ghz dual-band Wi-Fi, Ethernet Network (RJ45), minimum 02 x HDMI ports, USB port, A/V IN port, Headphone support available						
3	**Laptop**	**No.**	**1**				
	Laptop dedicated for video conference system, core i7 with latest generation, 16GB RAM, minimum 512 GB SSD, 15.6' Display, Licensed windows 10 or higher						
4	**UPS**	**No.**	**1**				
	1.5 KVA online UPS with dry batteries dedicated for the video conference system						
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities)		

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

D10 - WLAN Infrastructure

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	Wireless Local Area Network (WLAN)						
1	**Access Points with WLAN Controller**	**No.**	**17**				
	Compliance with IEEE 802.11ax and compatibility with IEEE 802.11 a/b/g/n/ac/ac Wave 2, Provides service on Tri-bands 2.4 GHz and 5 GHz bands and independent radio scanning, at a rate of 5.95 Gbps at least 570 Mbps at 2.4 GHz (2x2), at least 2.4 Gbps at 5 GHz (4x4), Must have 2x GE Ports, Built-in Omni directional antennas, Support 802.11k and 802.11v smart roaming, PoE+, Support WEP authentication/encryption, WPA2-PSK authentication and encryption, WPA2-802.1X authentication and encryption, Support at least 500 users per Radio, Built in controller, support 802.1x authentication and MAC address authentication and with complete installation, testing & commissioning and one year comprehensive warranty. Warranty Period shall start after signing of Handing Over/Taking Over Certificate. Hardware based WLAN controller (Qty=01) should support at-least 1000 access terminals and 250 network devices, Should support user authentication such as 802.1X authentication, MAC address authentication, Portal authentication, VPN authentication, and PPSK/DPSK authentication, Can automatically identify terminal types, vendors, and OSs, Support terminal identification such as MAC OUI, DHCP Option, LLDP and proactive modes such as SNMP, Can detect rogue APs and terminals in WIDS/WIPS mode and force them to go offline, Should support NAC solution, Support Default/ customized Dashboard with trend and statistic, Perpetual licenses for all quoted wireless access points must be included						
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities)		

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING (FINISHING WORKS FOR 4TH & 5TH FLOOR)

D-11 - Audio Video System for Auditorium				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
F	**Audio Video System**						
01-1F	Projector: High-resolution projector (minimum 1080p) with HDMI connectivity, ANSI Lumens rating of 5000 or higher, and compatible with HDCP (High-bandwidth Digital Content Protection) standards	No.	1				
01-2F	Projection Screen (26' x 15'): Motorized or fixed projection screen with a gain of 1.0 or higher, aspect ratio of 16:9, and compliant with ANSI/InfoComm standards for projection screens.	No.	1				
01-3F	Audio Mixer: Professional-grade audio mixer with a minimum of 12 input channels, individual channel EQ and gain control, and compliance with AES and EBU digital audio standards.	No.	1				
01-4F	Amplifiers: Power amplifiers with a minimum power output of 100 watts per channel, low distortion (THD < 0.1%), and compliance with relevant safety standards such as UL or CE	No.	3				
01-5F	Speakers: High-quality speakers with sufficient coverage and power handling capacity, designed for installation in large venues, and compliant with AES and EIA standards for sound reinforcement systems	No.	7				
01-6F	High-End Ultra-Low Frequency Subwoofer	No.	3				
01-7F	Professional Two way Moniter Loud Speaker	No.	2				
01-8F	Microphones: Wireless microphones (2 hand set)with clear and intelligible audio reproduction, frequency response range of 50Hz to 20kHz, and compliance with wireless spectrum regulations	No.	3				

D-11 - Audio Video System for Auditorium				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
01-9F	Audio Processors: Audio processors with built-in digital signal processing (DSP), equalization, and compression capabilities, complying with AES and EBU standards for audio equipment	No.	1				
01-10F	12 input and output Digital Matrix Processor	No.	1				
01-11F	Wiring of speakers from PA Rack with 2.5 sq.mm fire resistant 2 core (120 min) LSZH enhanced cable / manufacturer's recommended cable in already installed conduit.	No.	832				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities)		

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

D12 -IP BASED SURVEILLANCE & PID SYSTEMS

				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
	C. COMMUNICATION						
A	**IP based Surveillance System**						
	Camera & Allied Equipment Specifications						
1	**Outdoor Bullet Camera Type I**						
	IP Based POE outdoor Bullet Camera with 4 Mega Pixel resolution (2560 × 1440), Progressive Scan CMOS, minimum built-in IR distance up to 50 meter, varifocal motorized lens from 2.7 mm to 12 mm, 25/30 fps @ 4MP, H.264/H.265 compression, WDR, Back light Compensation (BLC), High Light Compensation (HLC),Intrusion, tripwire, Motion Detection, Automatic Gain Control (AGC),Video tempering, audio detection, Weather proof IP 67 rated, Operating Temperature -10°C to +55°C with junction box size 4x4 and complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	30				
2	**Boundary Wall Camera Type II**						
	IP Based POE outdoor Bullet Camera with 4 Mega Pixel resolution (2560 × 1440), Progressive Scan CMOS, 4MP (2560 × 1440)@30fps, minimum built-in IR distance up to 50 meter, 3.6 mm fixed lens, H.265/H.264, compression, WDR, High Light Compensation (HLC), Back light Compensation (BLC), Automatic Gain Control (AGC), Intelligent detection: Intrusion, tripwire crossing, Motion detection, Video tempering, Weather proof IP 67 rated, Operating Temperature -10°C to +55°C with junction box size 4x4 and complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	23				

D12 -IP BASED SURVEILLANCE & PID SYSTEMS				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
3	**PTZ Camera Type III**						
	IP Based PTZ Camera with 4 Mega Pixel resolution (2560 × 1440), minimum built-in IR distance 200 meter, 40 X or more optical Zoom, Pan Range: 360º, Tilt Range: Between -10° to 90°, 500 presets or more, H.264 and H.265 video/audio compression, WDR, Back light Compensation (BLC), High Light Compensation (HLC), Motion detection, Video tampering, Network disconnection, Automatic Gain Control (AGC), audio detection, Auto tracking, Privacy masking up to 20 areas or more, Weather proof IP 66 rated, ONVIF support, Operating Temperature -10°C to +60°C with junction box size 6x4 and power adapter, complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	7				
4	**8 Port PoE Industrial Switch (Type I) (For CCTV and PIDS)**						
	Fixed configuration PoE enabled manageable layer-3 switch, 8-Ports 10/100/1000 Mbps RJ-45 interface for camera connectivity over UTP, 2 dual 1G Ports for uplink connectivity (SFP Interface), 802.3af/at compliant built-in power supply, support PoE camera on all 8 ports upto minimum of 12.95 watts power or more simultaneously, MAC address entries should be 8k or higher, 2 GB RAM, power cable, IP40 or higher rated with installation, configuration & testing with standard manufacturer warranty	No.	13				
5	**8 Port UPoE Industrial Switch (Type II)**						
	Fixed configuration UPoE enabled manageable layer-3 switch, 8-Ports 10/100/1000 Mbps RJ-45 interface for camera connectivity over UTP, 2 dual 1G Ports for uplink connectivity (SFP Interface), MAC address entries should be 8k, 802.3bt Type 3 compliant redundant power supplies, support UPoE cameras on all 8 ports up to 60 watts power simultaneously, power cable, IP40 or higher rated with installation, configuration & testing with standard manufacturer warranty	No.	5				
6	**Single mode Fiber Optics cable**						
	8 Core Fiber Optic Cable Single Mode with Steel Tape armored cable with complete installation, testing and minimum 20 years comprehensive warranty	ft.	8000				
7	**8 Ports Rack Mountable Fiber Optic Patch Panel**						
	8 Ports Rack Mountable Fiber Optic Patch Panel OFDF Loaded capacity of 04 Nos. of LC Duplex Coupler with complete installation, testing and minimum one year comprehensive warranty	No.	18				

D12 -IP BASED SURVEILLANCE & PID SYSTEMS				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
8	**Fiber Patch Cord**						
	Fiber Patch Cord Duplex LC- LC Patch Cord, LSZH, 1 Meters with complete installation, testing and minimum one year comprehensive warranty	No.	44				
9	**pigtails**						
	Pigtail 1 meter, Single mode with complete installation	No.	44				
10	**Splicing**						
	Fiber Optic Cable Fusion Splicing Single Mode with complete installation	No.	44				
11	**Dual SFP module**						
	1 Gigabit dual SFP Module Single Mode LX/LH with standard manufacturer warranty	No.	44				
12	**Cat-6 4 Pair U/UTP Cable**						
	Cat-6 4 Pair U/UTP Cable with complete installation, testing and minimum 20 years comprehensive warranty	ft.	12000				
13	**UTP Patch Panel 8 Port**						
	UTP 8-Port Patch Panel with 8 I/O, complete with rear cable management and all accessories, installation and testing, standard manufacturer warranty	No.	18				
14	**Front Cable Manager 1U**						
	Rack mountable Front Cable Manager of size 1U with complete installation, testing and minimum one year comprehensive warranty	No.	18				
15	**Outdoor Data Cabinet**						
	Outdoor Data Cabinet Wall Mounted/ Surface Mount cabinet size: Width: 24 Inch, Height: 24 Inch, Depth: 18 Inch with PDU 3 port, IP67 rated, Weather and Rust Proof Power Coating, Fiber Splice Box, Temperature Control Sheet Inside, 20Ft Extra Fiber Optic Cable Rolling Option, 3 Pole 10AMP Schneider Breaker Inside, Earthing Strip and Electric Connectors, Fiber In/Out holding Clumps inside, Din Rail Fittings, Built-in Fan, Air Filter with exhaust Pocket, Removable Tray with Dual Shelfs, 1KVA Standard UPS Placing Option, Weather Proof, Lock and key, Dual Mounting Options Ground with concrete base and Wall Mount, Rain Shed with complete installation, testing and minimum one year comprehensive warranty	No.	18				

D12 -IP BASED SURVEILLANCE & PID SYSTEMS				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
16	**UPS 1KVA**						
	Power capacity: 1000 VA with 0.95 or higher Power Factor, Should supply clean, uninterrupted power to the critical loads and meet the specifications, Input voltage: 220 VAC, Output voltage: 220 VAC, pure sine wave, Rack Mountable, online double conversion technology or later, with Inverter and filter providing protection from sags, surges and brownouts, Built in surge protection and line conditioning , Must provide at least 20 minutes backup at full load of 1000 VA, Recharge time less than 6 hours, Maintenance free dry batteries, Serial or USB port for communication, 10/100 Mbps, RJ-45 port for LAN connectivity, Status LED indicator, Audible alarm, Plug and Play, UPS monitoring software, Network management through TCP/IP protocol, Automatic shutdown of non–attendant system, UPS can be connected in parallel and redundant up to multiple units even different power rating, Automatic battery test, Provide cold start functionality to enable power up without mains power supply present, Protection against battery dee lower, PLC can be integrated in to any new/ existing access control system, Safety: The Road Block	No.	18				
17	**UTP Patch Cord 1m**						
	UTP Patch Cord Cat-6 U/UTP of size 1 Meter with complete installation, testing and minimum 20 years comprehensive warranty	No.	144				
18	**Pole 8 ft**						
	8 ft. pole with arm, galvanized, concrete base and complete installation and manufacturer warranty	No.	28				
19	**Pole 14 ft**						
	10 ft. pole with arm, galvanized and complete installation and manufacturer warranty	No.	22				
20	**Pole 4 ft**						
	4 ft. pole with arm, galvanized and concrete base with complete installation and manufacturer warranty	No.	2				
21	**PVC Pipe 1" (For CCTV and PIDS)**						
	PVC Pipe 1" along with pipe bracket, solvent and installation charges and with standard manufacturer warranty	ft.	5000				
22	**Flexible Pipe**						
	Flexible pipe for cable termination	ft.	500				

D12 -IP BASED SURVEILLANCE & PID SYSTEMS				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
23	**PVC Pipe 2" (For CCTV and PIDS)**						
	HD Pipe 2" for outdoor digging along with bracket, solvent and installation charges and with standard manufacturer warranty	ft.	5000				
24	**PVC Pipe 2" For Electric Cable**						
	HD Pipe 2" for outdoor digging along with bracket, solvent and installation charges and with standard manufacturer warranty	ft.	2500				
25	**PVC Pipe 4" (For CCTV & PIDS)**						
	HD Pipe 4" for outdoor digging along with bracket, solvent and installation charges and with standard manufacturer warranty	ft.	5000				
26	**HDPE Pipe**						
	1" HDPE pipe	ft.	2000				
27	**Outdoor soft digging**						
	3 Feet Digging with concrete base, Backfilling and Civil Work for Fiber Optic and Electric Cabling	ft.	8000				
28	**Outdoor hard digging**						
	3 Feet Digging with concrete base, Backfilling and Civil Work for Fiber Optic and Electric Cabling	ft.	2000				
29	**Hand Hole**						
	Hand Holes (2'x2'x3' from inside) with minimum 2'6" diameter opening lid with complete installation & testing and with standard manufacturer warranty	No.	20				
30	**UTP Cable testing**						
	Fluke testing of UTP cabling infrastructure	Job	1				
31	**Fiber Testing**						
	OTDR Fiber cabling infrastructure testing	Job	1				
32	**RJ 45 Connectors**						
	RJ 45 connectors for UTP Cable	No.	300				
33	**Cable tags and labelling**						
	Polyethylene Cable tags with labelling	Job	1				
34	**Power Cabling**						
	2.5 core power cabling along boundary wall and internal connectivity	ft.	5000				
35	**Earthing**						
	Earthing of data racks/cabinets in complete aspects	Job	1				

D12 -IP BASED SURVEILLANCE & PID SYSTEMS				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
B	**Perimeter Intrusion Detection System (PIDS)**						
	Ref. Sec.No. 8337						
55	Electric based PIDS (non lethal) all along the external boundary comprising with steel electric fence, field settable dual zone energizer, batteries, power supplies, weather proof enclosure NEMA type 4X / IP67 rated suitable for corrosive environment, lightening diverter with flashing fence light and siren, keypad controller, synchronization card, stainless steel with support pipes, hot dip galvanished earth rod, black HDPE UV stablized strain & intermediate shielded insulators, nylon tensioning devices without spring or metal part, weather resistant line taps/ferrules, anchor bolts, factory printed UV stable warning plates, soild conductor minimum 1.6 / 1.2 mm stainless steel 316 grade fence wires and double insulated HT steel cables, LCD Display & server with perimeter patrol software, TCP/IP cards for LAN interface, alarm expansion board, all cables, equipment for monitoring and controlling in Command & Control Room interface with the function of CCTV system etc. all mounting and installation accessories including spares and any other essential equipment and cabling as required with all hardware, software and all associated civil works for satisfactory operation. Complete in all respect.	Job.	1				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities)		

HOME DEPARTMENT GOVERNMENT OF SINDH
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

D13 - WALKTHOUGH GATES & BAGGAGE SCANNING MACHINE

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
	C. COMMUNICATION						
A	**Walk Through Gates**						
6- 1T	Minimum 32 zone detection, consist of a free standing walk-through frame with an integral control unit, suitable to detect metallic objects on a person by means of the magnetic field principle, weather proof, suitable to detect ferrous and non-ferrous metals, Multiple horizontal zones of detection each with independent sensitivity adjustments, sensitivity of each zone can be adjusted from –99% to +99% in steps of 1%, A processor based continuous wave multiple sensor measurement method with self-testing diagnostics and high stability digital signal processing, Transmitter and receiver sensor elements positioned in both side panels and that scan both sides of the person being screened, tamper proof, Detection circuitry that remains permanently active and cannot be switched or programmed to a non-continuously active state, No photo-optic device that deactivates the detection or alarm circuitry, or permits a targeted weapon or object to be passed, slid or tossed through the detector undetected, Security on/off key lock and two 4 or 6 digit user selectable pass-codes, Standard user selectable detection programs designed to enhance discrimination and minimize orientation affect, metal detector shall not be adversely affected by stationary metal bars or structures in the vicinity of the unit or moving metal near the archway, capable of operating adjacent to an X-Ray inspection unit, The operation of the metal detector shall not be adversely affected by repositioning of the frame within certain limits of its original adjusted position, The unit shall be able to execute a full body scan and detect metal objects down to the lower feet level within the settings specified, The system shall operate by means of automatic level control adjustable to environmental changes without the need to reset, The sensitivity settings shall be consistent at average walking speed, Low intensity magnetic field that is safe for users of heart pacemakers, implanted defibrillators, pregnant women and magnetic storage media, The detectors shall be designed for connection to a 220V +/-5%, 50Hz, single phase, three wire (phase, neutral and earth) power supply, The system shall accept a passage of at least 50 persons per minute without functional overload, Wheel for detector mobility, Comply with EC Regulations and international standards relating to electrical safety and electromagnetic compatibility (EMC) with complete installation, testing & commissioning and with minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	3				

D13 - WALKTHOUGH GATES & BAGGAGE SCANNING MACHINE

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
B	**Baggage Scanning Machine**						
6- 2T	Tunnel size – 24.2 inches (width) x 16.7 inches (height), Conveyor belt speed should be 42 ft per minute or more, Conveyor Load Capacity 165 kg or more, L – shaped detector, The X-ray beam divergence should be complete image without corner cuts, edge trace/edge sharpening, Machines should operate on 220 VAC +/- 10%, 50/60 Hz power supply and should be able to with stand voltage fluctuations, X-ray Generator Tube voltage – 150 KV or more, Duty cycle – 100%, The radiation level should not exceed accepted health standard (0.1 mR/Hr at a distance of 5cm). Relevant certificate of federal standard regulations, The operating temperature normally should be 0 degree C to +40 degree C, Humidity – 90% non-condensing, Resolution – the machine resolution should be 40 AWG or more, Penetration should be 40mm thickness of steel (standard) or more, Continues electronic zoom facility should be available to magnify the chosen area of an image 32X or more , Video Display – 24 Inches Touch LCD With 1920 X1080 Resolution display, 3D Image Technology, All suspicious items (Explosives, High density material) should be displayed in one mode, Radiation Safety - The machine must comply with requirements of health and safety regulations with regard to mechanical electrical and radiation hazards. Before installation of the machine, the supplier/manufacturer should furnish relevant certificate from Atomic Energy Regulatory Board of Pakistan regarding radiation safety. The company manufacturing the equipment should have ISO certification for manufacturing and servicing of X-ray Screening machines, Film Safety - Guaranteed safety for high-speed films up to ISO1600. The machines should be film safe, rodent protected, Dust proof cover is to be provided for covering when system is not in use, Facility for variable contrast must be incorporated to allow enhancement of lighter and darker portion of the image, Machine should be capable for recalling previous images, It should have the capability of archiving images with date and time stamp, Images can be recorded in to any removable drive with complete installation, testing & commissioning and with minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	3				
	UPS 3 KVA						
6- 3T	UPS with 10 mins backup with complete installation, testing & commissioning and with minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	3				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities)		

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

D14 - IP 'Under Vehicle Surveillance System (UVSS)

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing &	Supply	Installation, Testing &
			a	b	c	d= a x b	e = a x c
	C. COMMUNICATION						
	Under Vehicle Surveillance System (UVSS)						
	Stationary UVSS System						
1	Capture images of a vehicle's undercarriage while in motion, Resolution: 20 MP, Color Image, Field of View: 180º, Illumination: 480W dynamic CCD LED array, Operate in all lighting conditions (daytime, night-time, etc.), The system must be equipped with a sensor; upon detection of an oncoming vehicle it would activate the scanning unit before the vehicle is physically moving over the lens of the scanning unit, Load bearing capacity 50 Tons or higher, Anti-fogging protection, The system must automatically display the full vehicle undercarriage image on the LED, The captured image must remain on the on-screen even after the vehicle passes for continued inspection, The scanning unit must be able to operate within -35°C to +60°C, The scanning unit must be equipped with a protection case and complete guide to facilitate the correct movement and positioning of the vehicle over it, The scanning unit must be anti-water, anti-dust, anti-damp, anti-frost, anti-fog, anti-crush, UVSS must handle vehicle speed between 10-70km/hour, UVSS must check the width viewing angle: <=4 meters and Vehicle chassis height<=0.19 ft with 22 inch color LCD Display Screen with keyboard Mouse, INTEL i5 processor, motherboard, 4GB or higher RAM, 1 TB HDD, stainless steel console Software Functions: Large format horizontal display, Supports querying the images according to the date, time and plate number. Supports adjusting the saturation, contrast, balance and sharpening of the images; supports zoom-in/out of the image, magnification can up to 16 levels; supports partial magnification. Automatic Storage/Deletion. Vehicle Chassis Information history Comparison. The software automatically finds and identifies suspicious items in the vehicle chassis, and automatically selects and prompts the suspicious items through the software to assist the operator	No.	1				

D14 - IP 'Under Vehicle Surveillance System (UVSS)				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing &**	**Supply**	**Installation, Testing &**
			a	b	c	d= a x b	e = a x c
	Hydraulic Road Blocker						
2	Blocker width: Three (03) Meters, Blocker body: Manufactured from heavy duty high grade steel, fully hot dipped galvanized for long term corrosion protection, Front plate, powder coated Black with Yellow stripes, Road plate, chequer plate / diamond plate, 8 ~ 10 mm, Steel, non-skid, plain galvanized finish, Hinges are of robust construction specially manufactured from heavy duty high grade steel designed for high volume traffic situations and harsh environments, The blocker is designed for pit mounting, a reinforced concrete foundation is required as per manufacturer's design, Cabinet: Weatherproof housing containing PLC, hydraulic power pack c/w hand pump and mains power supply unit, Cabinet is manufactured from Zintec Steel, powder coated Yellow 75 Micron MDFT, Hoses: 10 Meter long as standard, High grade PVC coated hydraulic hose, rated to 2250 psi, Raised Height: 600 ~ 800 mm, Raise / Lower: 5 seconds approx., Power: 230v AC 50 Hz Single Phase. 16 Amps start up, 6 Amps running, Control: Push Button rise / lower, PLC can be integrated in to any new/ existing access control system, Safety: The Road Blocker's moving part should at no place be overlapped with outer frame, Temperature: -20 to +60 C	No.	1				
	Hydraulic Tyre Killers						
3	Weight of a tyre killer will be 1-1.5 tons (depending on tyre killer type and accessories), Typical raise/lower time is 3 seconds, In case of emergency, raise/lower time can be as low as 1.5 seconds	Job	1				
	Signal Light Red & Green						
4	Signal Light Red & Green	No.	1				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities)		

HOME DEPARTMENT GOVERNMENT OF SINDH
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI
CONSTRUCTION OF MAIN LABORATORY BUILDING

D-15 - Integrated Building Management System (IBMS) Works

				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
1	**Controls for HVAC Plant Room Equipment**						
	Supply and installation of Automatic Controls for HVAC Plant Room Equipment including Chillers(3nos.), Cooling Towers(3nos.), Chilled Water Pumps(3nos.), Hot Water Pumps(3nos.), Condenser Water Pumps(3nos.), and Hot Water Generators(2nos.). Complete integration of Chillers and Hot Water Generators with BMS through built-in Communication Interfaces/Controllers. Supply and installation of Electromagnetic type Water Flow meters, all required sensors and field devices, VFDs for pumps, DDCs, pre-wired control panels, Complete in all respects as per Tender Specifications and Project Requirements.	Job	1				
2	**Controls for Air Handling Units (8 Nos.)**						
	Supply and installation of HVAC Controls for AHUs including VFDs, Humidity Sensors, Duct Temperature Sensors, Immersion Temperature Sensors, Differential Pressure Switches, One Damper with compatible Modulating Actuator for each lab area served by the AHU , Duct-type CO2 Sensor, 3-way Control Valves, Duct-type Smoke Detector, DDC Controller, and Pre-wired Control Panel with Transfomer and all Accessories, Complete in all respects as per Tender Specifications.	Job	1				
3	**Controls for Air Handling Units with DX-Condensing Units (6 Nos.)**						
	Supply and installation of HVAC Controls for AHUs including VFDs, Humidity Sensors, Duct Temperature Sensors, Immersion Temperature Sensors, Differential Pressure Switches, Modulating Damper Actuators, 3-way Control Valves, Duct-type Smoke Detector, integration/control of Dx-Condensing Unit, DDC Controller, Weather Proof Control Panel with Transfomer, relays and Complete Accessories, Complete in all respects as per Tender Specifications.	Job	1				

D-15 - Integrated Building Management System (IBMS) Works				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
4	**Controls for Plume Fans (5 Nos.)**						
	Supply and installation of HVAC Controls for Plume Fans including CT Switches, DDC Controller, and Pre-wired Control Panel with Transfomer,Relays and Complete Accessories, Complete in all respects as per Tender Specifications.	Job	1				
5	**Controls for Energy Recovery Ventilators (5 Nos.)**						
	Supply and installation of HVAC Controls for Energy Recovery Ventilators including Duct Temperature Sensors, Immersion Temperature Sensors, Differential Pressure Switches, 3-way Control Valve, Duct-type Smoke Detector, DDC Controller, Weather Proof Control Panel with Transfomer and Complete Accessories, Complete in all respects as per Tender Specifications	Job	1				
6	**Controls for Diesel Day Tank**						
	Supply and installation of HVAC Controls for Diesel Oil Day Tank Oil Level Sensors, DDC Controller, and Pre-wired Control Panel with Transfomer and Complete Accessories, Complete in all respects as per Tender Specifications.	Job	1				
7	**Controls for Electric Generators**						
	Complete integration of Electric Generators with BMS through built-in Communication Interfaces	Job	1				
8	**Controls for Energy Monitoring System**						
	Complete integration of Energy Monitoring System with BMS through built-in Communication Interfaces	Job	1				
9	**Controls for Elevators**						
	Complete integration with BMS through built-in Communication Interface of Elevator Controller	Job	1				
10	**Controls for Water Supply System/Potable Water System**						
	Supply and installation of Control System for water supply pumps and water tanks including water level sensors, DPS, current transducers, DDCs, pre-wired control panel with transformer and all accessories,Complete in all respects	Job	1				
11	**Controls for Fire Alarm System**						
	Complete integration with BMS through Main Fire Alarm Panel	Job	1				

D-15 - Integrated Building Management System (IBMS) Works				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
12	**Controls for Fire Fighting Pump Set**						
	Complete integration with BMS through built-in Communication Interface of Fire Pump Set Controller	Job	1				
13	**Controls for Smoke Extraction Fans (2 Nos.)**						
	Supply and installation of HVAC Controls for Smoke Extraction Fans including DP Switch, DDC Controllers, Dampers with On/Off Type Actuators (08 nos.)Pre-wired Control Panel with Transfomer,Relays and Complete Accessories, Complete in all respects as per tender Specifications	Job	1				
14	**BMS Server Equipment**						
	Supply and installation of BMS Workstation complete with licensed Windows 11 Professional OS, Mouse and Keyboard, 21" LED Monitor, Color Printer Size A3, BMS Software with license for upto atleast 05 concurrent users, UPS of 1.0 kVA rating	Job	1				
15	**Handheld Display Device/Tablet**						
	Supply of Handheld Display Device/Tablet for local monitoring/ parameter setting of DDC Controllers	Each	2				
16	**Cabling**						
	Supply and installation of Communication Cable for nearest available node Supply and installation of Control Cabling including Conduiting etc. Control Cabling for furture provision of lab areas where fume hoods are proposed	Job	1				
17	**Testing and Commissioning of BMS**						
	Testing and Commissioning of Complete BMS System including integration and interfacing with all systems as per Technical Specifications & Drawings	Job	1				
18	**Defects Liability Period (1 Year)**						
	Operation and Mainatenance of complete IBMS during DLP.	Job	1				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary)		

HOME DEPARTMENT GOVERNMENT OF SINDH
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI
CONSTRUCTION OF MAIN LABORATORY BUILDING

D-16: Disaster Recovery Site

				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissioning**	**Supply**	**Installation, Testing & Commissioning**
			a	b	c	d= a x b	e = a x c
Disaster Recovery Site (Server, SAN & Software)							
	Server						
1	2.5" Chassis with up to 12 SAS/SATA Drives, 2 CPU 2 x Intel® Xeon® Gold Processor, 28C/56T or higher, 12 x 64GB RDIMM 2 x 240GB SSD Hot-Plug Dual, Hot-Plug, Fully Redundant Power Supply (1+1), Remote Access Controller supported Dual Port 10/25GbE with SFP module Quad Port 1GbE BASE-T Adapter, PCIe Dual Port 10/25GbE with SFP module, PCIe Rack mountable, Sliding Rails With Cable Management Arm Support and warranty for 1 year	No.	2				

D-16: Disaster Recovery Site

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissioning	Supply	Installation, Testing & Commissioning
			a	b	c	d= a x b	e = a x c
	Storage Solution						
2	The unified storage requirement is divided into Structured and Un-structured data. The overall usable storage shall be minimum 200 TB Raw physical capacity and can be extendable up to 2 petabytes. 30% of the overall usable storage shall be used for structured data 70% of the overall usable storage shall be used for Un structured data It is recommended to have dedicated storages boxes for structured and un-structured data to achieve maximum performance. For Structured & Unstructured Data: Symmetric Active Active Controllers (64 Cores) TLC NVMe SSD drives shall be provided in the Storage Shall support future expansion in NVMe, end to end NVMe Shoud Support Active-Active Replication for SAN and NAS, The data communication link shall be minimum 25Gb Dual controller offered storage should not have any single point of failure. Hot spare drives must be available for fault tolerance Capacity planning chart must be shared with proposal. Minimum one hot spare drive per disk type must be proposed. Disk backend connectivity must be 25 Gbps or Higher Offered Storage shall support standard protocols FC, FCoE, iSCSI, to provide host connectivity. Redundant Power supply, Rack rails Must support Microsoft Windows Server 2012 and 2012 R2; Red Hat Enterprise Linux (RHEL) 6 and 7; SUSE Linux Enterprise Server (SLES) 11 and 12; VMware vSphere 5.1, 5.5, and 6.0. The contractor shall provide redundant SAN switches which shall be connected as per the data ports available in Servers and SANs. OM4 LC/LC multi-mode fiber cable patches 5 Meter or any other required Cables for data channel connectivity between Servers and SAN shall be provided accordingly. Support and warranty for 3 years The vendor should provide three (03) years warranty with 24 x 7 x 365 support with 4/8 hours SLA response time by Partner / OEM. The vendor should submit the proof of OEM's logistics center. Microcode of the Storage should be updated/upgraded by OEM. OEM should also have a local office for an emergency contact point.	Job	1				

D-16: Disaster Recovery Site				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissioning	Supply	Installation, Testing & Commissioning
			a	b	c	d= a x b	e = a x c
	Virtualization Platform for DR						
4	**Virtualization Management Software (01 Instance)** Proposed Solution must provide High Availability / Redundancy for Virtualization Management Platform on DR Site in case of anv disaster Must support to create and manage local Users with Role Based Access and Permission Control Must provide Web Bowser based Management Console Must provide complete visibility and centralized management / control of the Virtualization Platform Must provide capability to scale up to 64 nodes or better **Compute Virtualization (04 Sockets)** Proposed Solution should be highly redundant providing capability for the VMs to restart on another node in case of any Node failure in the Cluster Must provide VM Snapshot capability to revert back to previous point in time in case a failure or system error occurs Must provide VM Clone capability for creating cloned instances from source VM for testing or any other purposes Must provide VM vMotion capability to Live migrate VMs to any nodes in the Cluster without any downtime Must provide the capability to automatically hot-add resources including vCPUs and Memory real-time based on VM contention Must provide automated Resource Scheduling and Load Balancing capability for balanced performance on all nodes across the cluster Must provide Distributed Switch capability to configure and administer switching for the entire Cluster Must provide Hardware Health Check capability to Monitor CPU, Memory, Network Interface Card, Hard Drive and RAID Controller etc It should be 100% Compatible and integratrable with qouted Storage and Backup Solution (Hardware + Software) If Software License is on subscription based, proposed solution must be provided with 03 years Ent level subscription	No.	1				
	12-Port Layer-2 Manageable Network Switch						
5	1000 Base-T : 12 Ports • 1000 Base-X : 2 Ports • Bandwidth 112 Gbps • Non-blocking switching fabric 2 x 10G ports in basic configuration,RAM 2 GB, MAC table 32 K, Built in power supply, Front-to-Back or left to right cooling with complete installation, testing and minimum 1 year comprehensive warranty	No.	1				

D-16: Disaster Recovery Site

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissioning	Supply	Installation, Testing & Commissioning
			a	b	c	d= a x b	e = a x c
	Firewall						
6A	Next generation Firewall with throughput of 15 Gbps or higher with SFP and RJ45 port, dual redundant power supply, usb operator or console port, capable of web filtering, application control, IPs, URL filtering, anti pam, anti-malware Must Have Minimum 3.6 Gbps NGFW Throughput IMIX (FW + SA + IPS) Must Have Minimum 4 Gbps Threat Protection Throughput IMIX (FW + SA + IPS + Antivirus) IPsec VPN throughput ≥ 15 Gbit/s Must Have Unrestricted Concurrent User Must Have Minimum 1TB Storage Capacity Must Have Minimum 6 x 1G Ethernet Interfaces & 4x10G SFP+ Interfaces. Must Include Intrusion Prevention System (IPS), Anti-Virus & Anti-Malware, Email Security Protection, Web Filtering, Application Control, Bandwidth Management, Policy-based routing, RIP, OSPF, BGP, and IS-IS, Minimum 100 Concurrent Users for SSL VPN 3 Year Complete Security Features License 3 Year Software Upgrade & 24x7 Technical Support	No.	1				
6B	**Point to Point (P2P) connectivity between Main SFSL Site and DR site**	Job	1				
	Patch Panel 24 Port						
7	Patch Panel 24 Port Cat-6 loaded with Unshielded 12 IO with complete installation, testing and minimum one year comprehensive warranty	No.	1				
	Split type AC						
8	2 ton Split type AC	No.	2				
	UPS 3 KVA						
9	UPS 3KVA with 10 minute backup	No.	1				
	Allied Equipment						
10	UTP cable, patch cords, face plates, pipe e.t.c	Job	1				
	Internet Bandwith						
11	Committed Information Rate (CIR) Internet bandwith with two different backend channels (Fiber & Wireless) 100MBPS Usable Static IP's (06) for 1 year	Month	12				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities)		

HOME DEPARTMENT GOVERNMENT OF SINDH
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

D-17: IP Based PABX and Telephone System

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissioning	Supply	Installation, Testing & Commissioning
			a	b	c	d= a x b	e = a x c
	Supply, wiring, tagging, termination, design, installation, testing and commissioning of following system complete in all respects including all material, labor, tools, accessories etc. as per latest applicable international standards and technical specifications attached herewith						
1	**Voice Solution** Hybrid PABX having Capacity 500 lines (300 Analog, 100 IP system ports , 2 PRI, SIP (standard ports) 50 Ports, SIP plus version 25 Ports, SIP (Video version) 25 Ports, including Power Supply for allows operation at power failure for minimum 3 HOURS.	No	1				
2	**Software of IP PABX** • More than 2000 subscribers • Auto Provision • Certified as private branch exchange, rural, city, trunk • line, combined and international telephone exchange • Virtual PBX • Call center • Teleconference • Support for Session border controller functions • Support for a wide range of VAS (Value Added Services) • Geographic redundancy • Local redundancy • Load balancing • Flexible IVR builder • Monitoring and management • Support for widely used CRM systems, integration with • customer CRM • Operation under KVM and VMa Ware • Support for TTS (Text to speech) and ASR (Automatic speech recognition)	No	1				
3	**Reception Operator Console** • 14 fixed function keys dedicated to basic and enhanced • 10 Soft Keys that control access to the attendant features • Multiple call hold positions and line appearances • Intelligent Directory and Live Content Suite applications support • Secure Call Recorder Connector (SCRC) support as well as standard Record-a-Call functionality • Two integrated headset / handset jacks • Dual-port IP console (10/100 MB) switched • Ethernet) – connect a computer and a console • Operating Temperature: +4°C to +45°C • Relative Humidity: Up to 95%	No	1				
4	**16 Port Access Switch** • 1000 Base-T : 16 Ports • 1000 Base-X : 2 Ports • Bandwidth 112 Gbps • Non-blocking switching fabric • 4 x 10G ports in basic configuration • L3 functions • RAM (DDR3) 512 MB • ROM (RAW NAND) 512 MB • MAC table 32K • Stacking up to 8 devices • Builtin power supply • Dual ventilation system • Front-to-Back or left to right cooling	No	2				

D-17: IP Based PABX and Telephone System

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissioning	Supply	Installation, Testing & Commissioning
			a	b	c	d= a x b	e = a x c
6	**Access Switches layer 2 with SFP Managed** Fixed configuration PoE+ enabled manageable layer-2 switch with Rack Mount Kit, 24-Ports 10/100/1000 Mbps RJ-45 interface for connectivity over UTP, 2 x1G Ports for uplink connectivity (SFP Interface), 802.3af compliant built-in power supply, support PoE cameras with power budger of 400W, RAM should be 2GB, power cable, installation, configuration & testing with standard manufacturer warranty.	No.	1				
5	**48 Port Access POE with SFP Managed** Fixed configuration manageable layer 2 PoE switch, 48 x 10/100/1000Base T Ports, 4 x 10 GE SFP ports for SFP based uplink connectivity over fibre optics, Switching capacity 176 Gbps or higher, 2 GB RAM, support 802.1X authentication, MAC address authentication, support multiple VLANs, ACL, with complete installation, testing and minimum one year comprehensive warranty. Warranty Period shall start after signing of Handing Over/Taking Over Certificate.	No	1				
	Core Switch Layer 3 Stackable fixed configuration manageable Layer 3 Switch, Switching capacity: 1.92 Tbit/sec or higher, Optical interface: 24SFP Plus+ ports, 4QSFP Plus ports, (Optical interface 10GE ports, 40GE ports or 100GE ports card are supported), dual power supply, power cable, hot swappable redundant fans , Multi-layer switching and enhanced routing capability, Support of RIP, OSPF, DHCP snooping, Support ARP entries of 140K, Support multicast traffic, Software based fault tolerance, MAC Address entries should be minimum 200K, QoS and Filtering, Multi-layer switching and enhanced routing capability, Support multiple VLANs, Security features: 802.1x, Access Control Lists (ACLs), SNMP enabled, remote monitoring, Telnet support, Web based management interface with complete installation, configuration, testing and minimum one year comprehensive warranty	No	1				
7	**IP Executive Phone** • Power over Ethernet (PoE) • 2 SIP accounts • Auto provision (TR-069, DHCP) • Headset connection • Large LCD display • 3.2 inch (81 mm) backlit monochrome display, 128x64 resolutions • 6 programmable keys • Local 3 Way-conference	No	40				
8	**Analogue Phone with CLI** • Adjustable ringing volume • Adjustable Voice level • DTMF Dialing • Headset • Mountable on wall or desktop • Relative Humidity: up to 90%	No	209				
9	**50 pair Sub-Main Telephone Junction Boxes** (SMTJB) made with 16 SWG sheet steel housing, powder coated paint of approved color, consisting of specified Distributor Blocks / Tag Blocks for incoming and outgoing PTCL lines from ONU. Item includes all interconnecting jumper wiring and termination.	No	6				
10	**100 pair Sub-Main Telephone Junction Boxes** (SMTJB) made with 16 SWG sheet steel housing, powder coated paint of approved color, consisting of specified Distributor Blocks / Tag Blocks for incoming and outgoing PTCL lines from ONU. Item includes all interconnecting jumper wiring and termination.	No	3				

D-17: IP Based PABX and Telephone System

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissioning	Supply	Installation, Testing & Commissioning
			a	b	c	d= a x b	e = a x c
11	**Main Distribution Frame (MDF)** - (500 Pair wiring tag blocks)	No	1				
12	**Main Distribution Frame (MDF)** - (200 Pair wiring tag blocks)	No	2				
13	UTP CAT-7 for IP Phone IEEE802.3 10G Base-T, 23AWG Cable for Data Communication System from switch to each node/ outlet in 25 mm PVC conduit / channel including termination and tagging at both ends. Complete in all respects.	Lot	1				
14	50 Pair, copper conductor cable for Telephone System to be installed in Conduit. complete in all respects.	Lot	1				
15	25 mm PVC Conduit including Tees,Elbows,Joint Boxes etc complete in all respect	Lot	1				
				1. Sub-Total of Supply Amount (inclusive of GST where applicable)			
				2. Sub-Total of Installation, Testing & Commissioning Amount			
				3. SST @ 5% on Installation, Testing & Commissioning Amount			
				4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities)			

HOME DEPARTMENT GOVERNMENT OF SINDH
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D-18: Queue Management System				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissioning	Supply	Installation, Testing & Commissioning
			a	b	c	d= a x b	e = a x c
	C. COMMUNICATION						
	Queue Management System						
1	**17" Color LED with Touch Pad Kiosk Ticket Dispenser with Floor Stand**	**No.**	**1**				
	17" color LED with Touch Screen kiosk Ticket Dispenser, Multi language/ English printing, Transmitting way: Ticket Number : 0001-9999, Built in Thermal Printer, floor stand, Resolution: 1280 X 1024 pixels, TCP/IP, with software and customized reports, Temperature: 10-40 ºC with complete installation, configuration, testing and minimum one year comprehensive warranty						
	4 Digit Queue Display Counter						
2	4 Digit Queue Display Counter, Display called ticket number, counter number, Show numeric information such as waiting time and number of people in line, Scroll text in any direction, 300 mm wide, Operating temperature:-10 to 40 degree, with complete installation, configuration, testing and minimum one year comprehensive warranty	No.	1				
	Controller Hub						
3	Flush Mount Delegate unit should allow the delegate to talk, request to talk, Speaker automatically mutes when the microphone is turned on, Low susceptibility to mobile phone interference, Headphones volume control, Equipped with loud speaker and microphone, provision of headphone port, Centrally Powered and Controlled, Light Indication on Microphone when it is on with complete installation & testing and minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.	No.	1				
	Voice Announcement Machine						
4	Voice announcements for directing customers, Stores up to 6 hours of CD-quality stereo voice files, Volume Control, TCP/IP, Built in Power Amplifier, Operating temperature: 10 – 40°C, Storage capacity > 4 GB, Supported file formats riff wav (pcm), .mp3, support Urdu and English as a language in Voice, Connectable with Counter Display & Waiting area Display with complete installation, configuration, testing, and minimum one year comprehensive warranty	No.	1				

D-18: Queue Management System				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	Description	Unit	Qty	Supply	Installation, Testing & Commissioning	Supply	Installation, Testing & Commissioning
			a	b	c	d= a x b	e = a x c
	55" Waiting Area Display LED TV						
5	55" Full HD LED TV, Player Device (Android) , Flash Ticket number, counter number, show videos and images, Connectable with Management Software with complete installation, configuration, testing, and minimum one year comprehensive warranty	No.	1				
6	**Queue Management Software**	No.	1				
	Queue Management Module: Addition, Queue Depth settings, Deletion of tickets within queue etc. Services Management module: Addition, deletion, updation, time bound services, Assignment of queues with services etc. Ticket Management Module: Ticket designing and formatting, Ticket Contents updation/deletion/addition etc. Reporting Module: includes all reports related to queues, services, tickets, Performance management based on multiple criteria. Counter Management Module: Addition/Deletion/updation of users/managers/system administrators, Assignment of counters to User etc.						
	User/ Calling Software						
7	Call next customer, Transfer Ticket No, Select Priority, Change Priority, Staff login, Customizable Layout & Buttons	No.	16				
	Wall Speaker						
8	Wall Speaker	No.	4				
	Server for Management Software						
9	Core i7 11th generation or above, 16M Cache, minimum 3.6 GHz, 16 GB DDR4 RAM, 1 TB 7200 RPM HDD,100/1000 Mbps integrated Gigabit LAN & Wireless LAN card , FHD 21.5-inch LED display monitor, USB Keyboard & Mouse, pre-installed windows 10 or higher	No.	1				
	Desktop Computers						
10	Core i7 9th Gen or higher, 2.8 GHz base frequency or higher, Mother Board: Intel, 4GB DDR4 Ram, 1TB HDD, USB Wired Keyboard, USB 2.0 Optical Mouse with Scroll, LED Monitor 19", Built-in Gigabit Ethernet LAN , licensed Windows 10 Pro	No.	16				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount (Carried Over to Summary of Priced Bill of Quantities)		

APPENDIX – IIA TO BILL OF QUANTITIES

LIST OF IT EQUIPMENT MANUFACTURERS ON WHICH THE BID IS BASED (To be filled in and signed by the Bidder)*

The Material's and Equipment's required in the Bid shall be selected from the following recommended / approved manufacturer's / supplier's. The Bidder/sub Contractor shall procure the required materials and equipment's for this project from the following recommended / approved manufacturers / suppliers or their authorized dealer's / agent's.

The Bidder/sub Contractor shall also provide the letter of authenticity. Other makes may be accepted provided the quality and performance of such equipments in the sole opinion of the Engineer are atleast equal to or better than the equipment offered by the recommended manufacture list here under:-

The Engineer has the right to reject any of the alternate manufacturer proposed by the bidder/contractor other than listed manufacturer, without assigning any reason thereof.

S#	EQUIPMENT. / MATERIAL.	NAME OF MANUFACTURER.
1.	Local Area Network System	The quoted OEM Brands must fall in leader magic quadrant of Gartner at least once in last 3 years.
2.	Wireless Local Area Network	The quoted OEM Brands must fall in leader magic quadrant of Gartner at least once in last 3 years.
3.	UTP CAT 6-A Cable for LAN	3M CORNING CONTECH VIVANCO OR APPROVED EQUIVALENT
4.	UTP CAT 6 Cable for CCTV	3M CORNING CONTECH PANDUIT VIVANCO OR APPROVED EQUIVALENT
5.	Fiber Optics Cable	3M CORNING CONTECH PANDUIT VIVANCO OR APPROVED EQUIVALENT
6.	Fiber Optics Patch Panel	3M CORNING CONTECH PANDUIT VIVANCO OR APPROVED EQUIVALENT

Bidder's Seal and Signature

S#	EQUIPMENT. / MATERIAL.	NAME OF MANUFACTURER.
7.	Fiber Optics Patch Cord	3M CORNING CONTECH PANDUIT VIVANCO OR APPROVED EQUIVALENT
8.	Pigtail	3M CORNING CONTECH PANDUIT VIVANCO OR APPROVED EQUIVALENT
9.	SFP Module	CISCO JUNIPER HUAWEI OR APPROVED EQUIVALENT
10.	UTP Patch Panel	3M CORNING CONTECH PANDUIT VIVANCO OR APPROVED EQUIVALENT
11.	UTP Patch Cord	3M CORNING CONTECH PANDUIT VIVANCO OR APPROVED EQUIVALENT
12.	Cable Tags	LOCAL
13.	SIEM Solution	MICROSOFT SENTINEL SPLUNK QRADAR by IBM LOGRHYTHM FORTINET OR APPROVED EQUIVALENT
14.	Server Machines	DELL LENOVO HP OR APPROVED EQUIVALENT
15.	Storage	The quoted OEM Brands must fall in leader magic quadrant of Gartner at least once in last 3 years.
16.	Virtualization Software	VM WARE MICROSOFT CITRIX OR APPROVED EQUIVALENT

Bidder's Seal and Signature

S#	EQUIPMENT. / MATERIAL.	NAME OF MANUFACTURER.
17.	Fire Wall	The quoted OEM Brands must fall in leader magic quadrant of Gartner at least once in last 3 years.
18.	Microphone Conferencing System	TAIDEN BOSCH TELEVIC OR APPROVED EQUIVALENT
19.	Video Conferencing System	CISCO POLY HUAWEI OR APPROVED EQUIVALENT
20.	Queue Management System	QMATIC OR APPROVED EQUIVALENT
21.	Computer	DELL HP LENOVO OR APPROVED EQUIVALENT
22.	Laptop	DELL HP LENOVO OR APPROVED EQUIVALENT
23.	Data Rack	APC VERTIV HUAWEI ATTOM OR APPROVED EQUIVALENT
24.	Outdoor Data Racks	LOCAL
25.	UPS	APC GE VERTIV ATTOM OR APPROVED EQUIVALENT
26.	HDMI cable	IMPORTED
27.	PVC Conduits & Accessories / uPVC Pipes & accessories, Flexible pipe, HDPE Pipe	DADEX GALCO CIVIC POPULAR TURKPLAST OR APPROVED EQUIVALENT
28.	Power Cable	FAST CABLE NEWAGE CABLE PAKISTAN CABLE OR APPROVED EQUIVALENT
29.	Pole	LOCAL

Bidder's Seal and Signature

The Bidder/Sub contactor shall fill name of only one manufacturer for each equipment/material on which the Bid is based. He shall be bound to supply the equipment from the same manufacturer.

The names of the Manufacturer for each equipment/material filled in this Appendix by each Bidder shall be reviewed at the evaluation stage and if it is noted that any of the equipment/material offered by the Bidder does not meet the specification requirements or it is of unacceptable quality, the Engineer reserves the right to ask the Bidder before signing of the Contract to replace the manufacturer meeting the quality and specification requirements.

The Bidder must fill the list of Equipment/Material for all Systems as per format given below:

SR. NO.	EQUIPMENT. / MATERIAL.	NAME OF MANUFACTURER.	COUNTRY OF ORIGIN.

Bidder's Seal and Signature

APPENDIX – IIA TO BILL OF QUANTITIES

LIST OF COMMUNICATION EQUIPMENT MANUFACTURERS ON WHICH THE BID IS BASED (To be filled in and signed by the Bidder)*

The Material's and Equipment's required in the Bid shall be selected from the following recommended / approved manufacturer's / supplier's. The Bidder shall procure the required materials and equipment's for this project from the following recommended / approved manufacturers / suppliers or their authorized dealer's / agent's. The Bidder shall also provide the letter of authenticity. Other makes may be accepted provided the quality and performance of such equipments in the sole opinion of the Engineer are atleast equal to or better than the equipment offered by the recommended manufacture list here under:-

The Engineer has the right to reject any of the alternate manufacturer proposed by the bidder/contractor other than listed manufacturer, without assigning any reason thereof.

SR. NO.	EQUIPMENT. / MATERIAL.	NAME OF MANUFACTURER.
1.	Addressable Fire Alarm System	GENT BY HONEYWELL NOTIFIER OR APPROVED EQUIVALENT
2.	Addressable Fire Alarm Cable	PRYSMIAN CAVICEL FIRECEL OR APPROVED EQUIVALENT
3.	Public Address System	TOA BOSCH WHARFEDALE PRO OR APPROVED EQUIVALENT
4.	Public Address Speaker Cable	PROEL PRYSMIAN CAVICEL FIRECEL OR APPROVED EQUIVALENT
5.	Perimeter Intrusion Detection System	NEMTEK OR APPROVED EQUIVALENT
6.	UTP CAT 6 Cable for CCTV	3M CORNING CONTECH VIVANCO OR APPROVED EQUIVALENT
7.	Fiber Optics Cable	3M CORNING CONTECH VIVANCO OR APPROVED EQUIVALENT
8.	CCTV based Surveillance System	BOSCH DAHUA HIKVISION OR APPROVED EQUIVALENT

Bidder's Seal and Signature

SR. NO.	EQUIPMENT. / MATERIAL.	NAME OF MANUFACTURER.
9.	Video Wall	SAMSUNG PANASONIC HIKVISION DAHUA OR APPROVED EQUIVALENT
10.	Video Wall Controller	HIKVISION DAHUA DIGIBIRD OR APPROVED EQUIVALENT
11.	Keyboard Controller	BOSCH HONEYWELL DAHUA HIKVISION OR APPROVED EQUIVALENT
12.	Embedded Storage	BOSCH HONEYWELL DAHUA HIKVISION OR APPROVED EQUIVALENT
13.	Employee Attendance System	HIKVISION ZKTECO OR APPROVED EQUIVALENT
14.	Access Control System	HIKVISION ZKTECO OR APPROVED EQUIVALENT
15.	EM Lock	ZK TECO OR APPROVED EQUIVALENT
16.	Exit Button	ZK TECO OR APPROVED EQUIVALENT
17.	Walk through gates	GARRATE CEA OR APPROVED EQUIVALENT
18.	Baggage Scanning Machine	RAPISCAN ASTROPHYSICS OR APPROVED EQUIVALENT
19.	Under Vehicle Surveillance System	DAHUA HIKVISION OR APPROVED EQUIVALENT
20.	Hydraulic Road Blocker	DAHUA HIKVISION OR APPROVED EQUIVALENT
21.	Hydraulic Tyre Killer	DAHUA HIKVISION OR APPROVED EQUIVALENT
22.	Signal Light (Red & Green)	LOCAL

Bidder's Seal and Signature

SR. NO.	EQUIPMENT. / MATERIAL.	NAME OF MANUFACTURER.
23.	Computer	DELL, HP, LENOVO OR APPROVED EQUIVALENT
24.	Laptop	DELL HP LENOVO OR APPROVED EQUIVALENT
25.	Data Rack	TOTEN VERTIV VIVANCO CONTECH OR APPROVED EQUIVALENT
26.	Outdoor Data Racks	LOCAL
27.	UPS	APC GE DOUCHE POWER ABB OR APPROVED EQUIVALENT
28.	HDMI cable	LOCAL
29.	PVC Conduits & Accessories / uPVC Pipes & accessories, Flexible pipe, HDPE Pipe	DADEX GALCO CIVIC POPULAR TURKPLAST OR APPROVED EQUIVALENT
30.	Power Cable	FAST CABLE NEWAGE CABLE PAKISTAN CABLE OR APPROVED EQUIVALENT
31.	Pole	LOCAL

The Bidder shall fill name of only one manufacturer for each equipment/material on which the Bid is based. He shall be bound to supply the equipment from the same manufacturer. In case, the Bidder gives names of more than one manufacturer against any equipment, the Engineer is authorized to ask the Bidder to supply the equipment from any one of them.

The names of the Manufacturer for each equipment/material filled in this Appendix by each Bidder shall be reviewed at the evaluation stage and if it is noted that any of the equipment/material offered by the Bidder does not meet the specification requirements or it is of unacceptable quality, the Engineer reserves the right to ask the Bidder before signing of the Contract to replace the manufacturer meeting the quality and specification requirements.

The Bidder must fill the list of Equipment/Material for all Systems as per format given below:

SR. NO.	EQUIPMENT. / MATERIAL.	NAME OF MANUFACTURER.	COUNTRY OF ORIGIN.

Bidder's Seal and Signature

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

INTEGRATED BUILDING MANAGEMENT SYSTEM (IBMS) WORKS
LIST OF RECOMMENDED MANUFACTURERS & SUPPLIERS

It is to noted by the Bidder that the equipment/materials from the following recommended manufacturers/suppliers or approved equivalent source shall be allowed to be utilized on subject project provided that the proposed products meet the specified requirements of the bidding documents. All equipment/materials shall be supplied from the Manufacturer's own Factory/Plant/Facility.

No.	Item	Recommended Manufacturer & Supplier	Country (Origin, Manufacturing, Assembling, Testing & Supply)
1	Integrated Building Management System Software	Honeywell	USA/West Europe
		Siemens	
		Johnson Controls	
		Schneider Electric	
2	DDC Controllers, Sensors and field devices	Honeywell	USA/West Europe/China
		Siemens	
		Johnson Controls	
		Schneider Electric	
3	IBMS Accessories, Transformers & Relays etc.	As approved by the Engineer	USA/West Europe/China
4	Imported Dampers with Actuators	Trox	As per Manufacturer's Facility
		Green Heck	
		Metal Air	
		Belimo	
		Ruskin Titus	
5	Data & Control Cables	Belden	As per Manufacturer's Facility
		Schneider Electric	
		Corning/3M	
		Contech	
		Commscope/Systimax	
6	Low Voltage Panels	Siemens	Pakistan
		Grand	
		PEL	
		Bilal Switchgears	
		Mesi	
7	uPVC Conduits & Fittings	Dadex Eternit	Pakistan
		International Industries Limited (IIL)	
		Popular	
8	Server & Computer Hardware	IBM	As per Manufacturer's Facility
		Dell	
		Lenovo	
		Hewlett Packard (HP)	

INTEGRATED BUILDING MANAGEMENT SYSTEM (IBMS) WORKS
LIST OF RECOMMENDED MANUFACTURERS & SUPPLIERS

It is to noted by the Bidder that the equipment/materials from the following recommended manufacturers/suppliers or approved equivalent source shall be allowed to be utilized on subject project provided that the proposed products meet the specified requirements of the bidding documents. All equipment/materials shall be supplied from the Manufacturer's own Factory/Plant/Facility.

No.	Item	Recommended Manufacturer & Supplier	Country (Origin, Manufacturing, Assembling, Testing & Supply)
9	LAN Equipment (Network Swicthes)	Cisco	As per Manufacturer's Facility
		Huawei	
		H3C	
		Juniper	
		D-Link	
10	LAN Passive Equipment (Patch Panels, I/O, Face Plates etc.)	Belden	As per Manufacturer's Facility
		Schneider	
		Corning/3M	
		Contech	
		Commscope/Systimax	
11	UTP LAN Cabling (including Patch Cords)	Belden	As per Manufacturer's Facility
		Schneider	
		Corning/3M	
		Contech	
		Commscope/Systimax	

NOTES:

1. All components/material shall be supplied through authorized distributors.
2. Manufacturer's authorization certificate shall be provided.
3. Compliance to the aforementioned country (origin, manufacturing, assembly, testing & supply) for offered equipment/material is mandatory.
4. If any approved equal brand other than the aforementioned recommended manufacturers/suppliers is proposed, then the bidder shall submit the following additional information for prequalification with the technical bid;

a) Compliance of equipment parts and their origin as mentioned in technical specifications.
b) Compliance statement of technical specification/standards through the equipment manufacturer.
c) Approved equal brand shall clearly be mentioned in the technical bid along with the above said information.
d) Minimum fifteen (15) years of international experience for same offered equipment/material brand.

e) Minimum five (05) years national experience with local authorized distributor and after sale services available in Pakistan.

Authorized Signature & Official Seal: _____
Name: _____
Date: _____

SPECIAL PROVISIONS FOR TELECOMMUNICATION WORKS

1. Home Department, Government of Sindh wishes to receive Bids for procurement of IT Systems for Sindh Forensic Science Laboratory and provide services such as installation, configuration, testing, training, support, warranty and other such obligations. Execution/installation of all Systems shall be carried out at Sindh Forensic Science Laboratory, Karachi.

2. At the minimum, the Project team should comprise of the following resources:

Sr. No.	Team Designation	No. of Resources
Project Management		
1.	Project Manager	01
Technical Team for LAN & WLAN		
1.	System Designer (Must be System certified for LAN & WLAN)	02
2.	Site Engineer	02
3.	Configuration & Testing Engineer (Must be System certified)	02
4.	Certified Cable Installer & Supervisor	02
5.	Trainer	
Technical Team for Network Management & Monitoring		
1.	System Designer (Must be System certified)	01
2.	Configuration & Testing Engineer (Must be System certified)	01
3.	Trainer	01
Technical Team for Establishment of Data Center		
1.	System Designer (Must be System certified)	01
2.	Site Engineer	01
3.	Configuration & Testing Engineer (Must be System certified)	01
4.	Certified Cable Installer & Supervisor	01
5.	Trainer	01
Technical Team for Servers & Storage		
1.	System Designer (Must be System certified)	02
2.	Configuration & Testing Engineer (Must be System certified)	02
3.	Trainer	01
Technical Team for Microphone Conferencing System		
1.	System Designer (Must be System certified)	01
2.	Configuration & Testing Engineer (Must be System certified)	01
3.	Certified Cable Installer & Supervisor	01
4.	Trainer	01

3. During the execution of the Project, change in nominated staff member may be made after getting approval from Consultant/Engineer Incharge. The proposed team member must have same or higher qualification in terms of education, experience etc. as compared to the team member being replaced.
4. Bidder shall provide a methodology and work plan for carrying out the work of the entire Contract. Detail should be given to indicate the sequence and time period during which the bidder shall complete the Works including the activities like low level design/configuration, schedule of submittal of drawings, ordering, procurement and delivery of IT Equipment, installation, testing and commissioning of items, training schedule and detail of warranty and after sales service.
5. The Bidder shall submit a Training methodology and plan to clearly identify the level of training i.e., user/administration, duration, schedule etc.
6. The Bidder shall submit a support plan highlighting the service and support structure and response times. It shall also include the service detail after the lapse of initial warranty period. The plan shall also identify the downtime for each level of service program.
7. The bidder shall attach / submit Valid Distribution/Partnership Letter (Not Older than One Year) from the Principal.
8. The Bidder shall provide documentary evidence that the bidder has been duly authorized by the Principal manufacturer to supply and install the equipment for Sindh Forensic Science Laboratory Project. The bidder shall attach / submit Valid Authorization Letter from the Principal specifically for this project especially for Servers, Storage and Network Equipment.
9. The Bidder shall provide operational experience certificates of proposed Equipment issued by the Clients for last 5 years.
10. The Bidder shall provide brochures/ technical data sheet of proposed Equipment.
11. The Bidder shall provide documentary evidence that the equipment to be supplied by the bidder conforms to the Tender specifications. The documentary evidence may be in the form of literature, drawings and data and shall furnish:

    (a) A detailed description of the equipment, essential technical and performance characteristics.

    (b) Complete set of technical information, description data, literature and drawings as required. This will include but not be limited to the following:

        (i) A sufficient number of drawings, photographs, catalogues, illustrations and such other information as is necessary to illustrate clearly the significant characteristics such as general construction dimensions and other relevant information about the equipment to be furnished.

        (ii) Any other information which is required for evaluation purposes.

13. The equipment supplied under this Contract shall conform to the authoritative latest standard appropriate to the equipment.

14. Quoted Equipment shall not be EOL and EOS in next 5 years.

15. The Consultant/Engineer Incharge or its representative shall have the right to inspect the work being carried out under this Contract and to test the equipment for conformance with Tender specifications.

16. The inspections and tests may be conducted on the premises of the successful bidder or its subcontractor(s), at point of delivery and at the Service final destination. Where conducted on the premises of the successful bidder 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 Consultant/Engineer Incharge.

17. Should any inspected or tested Service fail to conform to the specifications, the Consultant/Engineer Incharge may reject them, and the successful bidder shall either replace the rejected Service or make all alterations necessary to meet the requirements of the Specifications free of cost to the Consultant/Engineer Incharge.

18. The Consultant/Engineer Incharge has right to inspect, test and, where necessary, reject the equipment after their delivery at the site of installation shall in no way be limited or waived by reason of the equipment having previously been inspected, tested and passed by the Consultant/Engineer Incharge prior to delivery of the Goods.

19. Special Instructions for Bidder:

Server, Storage and Virtualization Equipment
▪ Must Be Compatible with Any Brand of Intel x86 Architecture Hardware Servers. ▪ Must Have OEM Presence in Pakistan for Minimum 5-7 Years or more. ▪ Must Have Minimum 10 similar nature Data Center level deployments with the required similar nature components i.e. Compute Virtualization, Storage Virtualization. (Documentary Evidence must be submitted) ▪ The quoted OEM Brands must fall in leader magic quadrant of Gartner at least once in last 3 years. (Documentary Evidence must be submitted)
LAN & WLAN
▪ Must Have OEM Presence in Pakistan for Minimum 5-7 Years or more. ▪ Must Have Minimum 10 High End LAN/WLAN Deployments. (Documentary Evidence must be submitted) ▪ The quoted OEM Brands must fall in leader magic quadrant of Gartner at least once in last 3 years. (Documentary Evidence must be submitted)

Cargo Elevator
(BOQ Code E-1)

HOME DEPARTMENT GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

CONSTRUCTION OF MAIN LABORATORY BUILDING

E-1: ELEVATOR WORKS - CARGO ELEVATOR

				Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
Item No.	**Description**	**Unit**	**Qty**	**Supply**	**Installation, Testing & Commissiong**	**Supply**	**Installation, Testing & Commissiong**
			a	b	c	d= a x b	e = a x c
	ELEVATOR WORKS						
	Ref. Specifications						
01-01	Supply, installation, testing & commissioning of imported brand new freight elevator (through/double entrance machine room type), traction type, heavy duty fully complied & certified by EN 81-20, EN 81-50 and EN 81-70 standards including minimum features but not limited to VVVF high efficiency motor elevator complete inside stainless steel hairline or as approved by the engineer finish, indoor type for ambient condition of 0~40 °C, capacity of 5000 kg, Cabin Size 2600×3400×2500 (W×D×H) mm, speed 0.5~1.0 m/s, 06 stops/07 openings, approx. total travel height 21.34 meter, entrance 2500×2400 (W×H) mm. Lift shall minimum includes car, hoisting machinery, counter-weight, supports, brackets, automatic controls,embedded parts, access ladder, separator screen & trap door, electric overload, shaft lightening, intercom system, gong, emergency operation for cabin/door, emergency rescue device (ups/battery) safety devices & Manual emergency operation lever, all essential spare parts including parts to be used during One (01) year of defect liability period complete in all respects as per specifications (Appendix), drawings and EN 81 standard compliance. All taxes/ duties/ levies shall be included.	No.	1				
01-02	Civil and Allied Works relevant to necessary adjustments which will be required during installation of new equipment.	Lot	1				

CONSTRUCTION OF MAIN LABORATORY BUILDING

E-1: ELEVATOR WORKS - CARGO ELEVATOR

Item No.	Description	Unit	Qty	Priced Bill of Qantities			
				Unit Rate (Rs.)		Amount (Rs.)	
				Supply	Installation, Testing & Commissiong	Supply	Installation, Testing & Commissiong
			a	b	c	d= a x b	e = a x c
01-03	Electrical & Ancillary Works for elevator, fan & AC including outside DB to elevator, breakers cabling and other accessories etc. (Complete in all respect).						
a)	Electrical DB	No.	1				
b)	Relevant electrical works including cables, conduits, hangers, supports etc. complete in all respect except DB mentioned in Item here above.	Lot	1				
01-04	Supply and installation of exhaust fan propeller type of size Dia 12"	No.	1				
01-07	Supply and installation of Wall Mounted Split Air Conditioner Unit (Inverter type) of Minimum Capacity 2TR	No.	1				
01-08	Pre shipment/Third party Inspection as specified in bidding documents	Lot	1				
01-09	Third party validation for Testing & commissioning of elevator in Pakistan	Lot	1				
01-10	Regular daily Operation (12 hours / day, 6 days / week and 300 days / year) during One (01) year of Defects Liability Period.	Months	12				
					1. Sub-Total of Supply Amount (inclusive of GST where applicable)		
					2. Sub-Total of Installation, Testing & Commissioning Amount		
					3. SST @ 5% on Installation, Testing & Commissioning Amount		
					4. Total of Supply Installation, Testing & Commissioning (1+2+3) Amount		

BIDDER'S EQUIPMENT DATA

ELEVATOR WORKS

Note: Data provided hereunder will be scrutinized for general conformity with requirements of Bidding Documents. Acceptance of Bid will not mean acceptance of these data. The Contractor will have to submit detailed equipment submittals for approval of the Engineer in accordance with Special Provisions of Specifications later after award of Contract. Failure to complete these forms may make the Bid non-responsive.

Typewritten technical data on loose sheets if submitted by the Bidder will not be considered and will be simply ignored.

Technical catalogues are required only to substantiate the data provided in these forms. Catalogues of equipment not listed in these forms shall not be submitted and if submitted, will be ignored. Acceptance of Bid will not mean the acceptance of information given in those catalogues. Model Number and Technical Specifications mentioned in Technical Bid are considered for reference only. The Bidder/Contractor will submit Technical Submittal of the proposed model after award of work with full compliance of Bidding Documents for the Engineer's review and approval. No reference model and technical specifications accompanied with the Bid are supposed to be final until Engineer's approval of the Technical Submittal.

A. ELEVATORS

1.	Make	_____
2.	Country of Manufacture	_____
3.	Model	_____
4.	Public Heavy Duty Lifts model (Yes/No)	_____
5.	Offered Model is latest and available on Manufacture`s Website (Yes/No)	_____
6.	All Elevator parts are being supplied through the Offered Manufacturer (Yes/No)	_____
7.	All material/equipment supplied shall be EN 81-20, 50 & 70 Complied (Yes/No)	_____
8.	All elevators offered model catalogue specifications/ Attributes/ material are not modified for subject Project (Yes/No)	_____

Note: Confirmation required against Items 4, 5, 6, 7 & 8 mentioned above in "Yes". Failure to comply the said data can lead to rejection of Technical Bid.

Initials of Signatory to Bid: _____

MAJOR ELEVATOR PARTS COMPLIANCE SHEET

Following elevator parts shall be supplied by offered elevators manufacturer\brand and supplied from same manufacturing facility location as offered brand. Following Table shall be separately filled for each type of elevators as per project requirements. This shall be filled/complied by all recommended manufacturer or approved equal brands.

Sr. No.	Description	Model No.	Manufacturer/ Supplier Name with Country of Origin	EU Type Examination Certificate No.	Supplying Through the main Elevator Brand Factory (Y/N)
1	Machine/Motor				
2	Main Elevator Controller/ PCB Card				
3	Over Speed Governor				
4	Safety Gear				
5	Electric Safeties				
6	Door Operator				
7	Car Door/ Locking Devices				
8	Landing Doors/ Locking Devices				
9	Door Protection Device				
10	Traction Belt				
11	Car\Call Operation Panel				
12	Car cabin				
13	CWT filler (50% Cast Iron & 50% Concrete with Cast Iron Frame)				
14	Car Guide Rail				
15	CWT Guide Rail				
16	Travelling Cable				
17	Buffers				
18	Halogen Free Cables				
19	Emergency Rescue Device				
20	Seismic Sensor				
21	Ropes\Belts				
22	PCB Card for Remote Monitoring				

Note: Confirmation and details required against mentioned items here above in "Y" and EU type examination certificates shall be online verifiable. Failure to comply the said data can lead to rejection of Bidder's Technical Bid.

LIST OF RECOMMENDED MANUFACTURERS
ELEVATOR WORKS

The Bidder should note that Equipment/materials from the following recommended manufacturers or approved equivalent shall be allowed to be used on this Project provided that recommended/approved equivalent manufacturers meet the specified requirements given in the Bidding Documents and in the notes given here under.

SR. NO.	EQUIPMENT/ MATERIAL	RECOMMENDED MANUFACTURER/ SUPPLIER	COUNTRY (origin, manufacturing, assembly, testing & supply)
1.	Elevators	DOPPLER HYUNDAI KONE MITSUBISHI OTIS SCHINDLER SHANGHAI MITSUBISHI THYSSEN KRUPP SIGMA	WEST EUROPE KOREA, CHINA WEST EUROPE, CHINA JAPAN WEST EUROPE, CHINA WEST EUROPE, CHINA CHINA WEST EUROPE, CHINA KOREA, CHINA
2.	Split Air Conditioner	MITSUBISHI DAIKIN LG PEARL MIDEA SAMSUNG	As Per Recommended Manufacturer/Supplier
3.	Low Voltage Panel Distribution Board (DB)	ELECTRECH SIEMENS PEL BILAL SWITCHGEAR MESI ALSTOM/AREVA	PAKISTAN
4.	LV and Control Cables and Wires (600/1000V)	PAKISTAN CABLES PIONEER CABLES NEWAGE CABLES FAST CABLES	PAKISTAN
5.	PVC Conduit and Accessories	POPULAR GALCO	PAKISTAN

6.	Steel Conduit and Accessories	HILAL INDUSTRIES ILL JAMAL PIONEER BASHIR	PAKISTAN
7.	MCCBs, MCB	MERLIN GERLIN (MG) SIEMENS ABB LEGRAND TERASAKI	FRANCE/GERMANY/ ITALY/JAPAN
8.	Magnetic Contactors	ABB PANASONIC GREEN POWER TELEMECANIQUE	ITALY/FRANCE/JAPAN
9.	ACBs, ELCBs	ABB SIEMENS MG TERASAKI	ITALY/GERMANY/ FRANCE/JAPAN
10.	Relays and Timers	FINDER INTER	ITALY/TURKEY
11.	PFI Relays	NOKIAN ENTES	FINLAND/JAPAN/ TURKEY
12.	Voltmeters/Ammeters	CIRCULOR REVALCO INTER ENTES	ITALY/TURKEY
13.	Selector Switches/Push Button	KRAUS & NAIMER ABB LEGRAND REVALCO	SWEDEN/FRANCE/ ITALY
14.	Indication Lamps	LEGRAND BRETER ABB TELEMECANIQUE	FRANCE/ITALY
15.	Terminal Blocks	LEGRAND ABB PHOENIX CABOUR	FRANCE/ITALY/JAPAN
16.	LV Change over Switch Capacitors	SOCOMEC, ABB, AMBER, NOKIAN, DUCATI	FRANCE/GERMANY/ JAPAN/PAKISTAN
17.	Paint	ICI, MASTER PAINTS, BERGER	PAKISTAN

18.	Fasteners, Hanging Rods, Rawal Plugs etc.	FISHER , HILTI, SPIT	WEST EUROPE
19.	Exhaust Fan	GFC PAKFAN CLIMAX ROYAL LAHORE	PAKISTAN
20.	All equipment/ Materials other than stated above	Make and Country of Origin approved by Engineer	

NOTES:

1. ALL EQUIPMENT/MATERIAL MUST BE SUPPLIED FROM AUTHORIZED DISTRIBUTORS.

2. MANUFACTURERS AUTHORIZATION CERTIFICATE IN ORIGINAL MUST BE PROVIDED.

3. COMPLIANCE TO THE MENTIONED COUNTRY (ORIGIN, MANUFACTURING, ASSEMBLY, TESTING & SUPPLY) FOR OFFERED/SUPPLIED EQUIPMENT IS MANDATORY.

4. IN CASE A BIDDER OFFERS AN 'APPROVED EQUIVALENT' BRAND/EQUIPMENT, IT SHALL BE CLEARLY STATED IN THE TECHNICAL BID AND ALL REQUISITE DATA/DOCUMENTATION FOR QUALIFICATION/EVALUATION OF SAID BRAND/EQUIPMENT SHALL BE PROVIDED IN THE TECHNICAL BID IN ACCORDANCE WITH REQUIREMENTS PROVIDED IN BIDDING DOCUEMTNS AND APPENDIX-B OF INSTUCTIONS TO BIDDERS.

Initials of Signatory to Bid: _____

C-1
Schedule-C to Bid

CONSTRUCTION SCHEDULE

Pursuant to Sub-Clause 8.3 of the General Conditions, the whole of the Works, and each Section (if any), shall be completed within the Time for Completion for the Works or Section (as the case may be) stated as hereunder and mentioned in Contract Data:

Description	Time for Completion (days)
Whole Works	**365 days**
• FM 200 (BOQ Code A-1)	120 days
• Energy Monitoring, Diesel Generator & Allied Works (BOQ Codes B-1 & B-2)	180 days
• HVAC Ducting (BOQ Code C-1)	365 days
• ELV system & other works (BOQ Codes D-1 to D-18)	365 days
• Cargo Elevator (BOQ Code E-1)	120 days

[The Bidder shall provide, the Construction Schedule in the bar chart (CPM, PERT or any other to be specified herein) showing the sequence of work items and the period of time during whichhe proposes to complete each work item in such a manner that his proposed programme for completion of the whole of the Works and Sections of the Works may meet Employer's completiontargets in days noted above and counted from the Commencement Date (Attach sheets as required for the specified form of Construction Schedule).

D-1
Schedule-D to Bid

METHOD OF PERFORMING THE WORK

[The Bidder is required to submit a narrative outlining the method of performing the Work. Thenarrative should indicate in detail and include but not be limited to:

1. Organization Chart:
   Shall indicate head office and field office personnel involved in management and supervision,engineering, equipment maintenance and purchasing.

2. Mobilization:
   In Pakistan, the type of facilities including personnel accommodation, office accommodation,provision for maintenance and for storage, communications, security and other services to beused.

3. Method of executing the Works:
   The procedures for installation of equipment and machinery and transportation of equipment and materials to the site.]

E-1
Schedule-E to Bid

LIST OF MAJOR EQUIPMENT

The Bidder will provide on Sheet E-2 of this Schedule a list of all major equipment and related items, under separate heading for items owned, to be purchased or to be arranged on lease by him to carry out the Works. The information shall include make, type, capacity, and anticipated period of utilization for all equipment which shall be in sufficient detail to demonstrate fully that the equipment will meet all requirements of the Specifications, Project Completion time and Schedule.

Note:
The Bidder while preparing his methodology for performing and executing the works and listing out Major Equipment (required to complete the Works in the specified Time Schedule) in this Appendix shall consider the above-mentioned minimum requirement of Construction Equipment to be brought/installed/erected at site

E-2
Schedule-E to Bid

LIST OF MAJOR EQUIPMENT

Owned, Purchased or Leased

Owned Purchased or Leased	Description of Unit(Make, Model, Year)	Capacity HP Rating	Condition	Present Location or Source	Date of Delivery atSite	Period ofWork on Project
1	2	3	4	5	6	7
a. Owned						
b. To be Purchased						
c. To be arranged on Lease						

E-3
Schedule-E to Bid

LIST OF MAJOR EQUIPMENT

Equipment details

Item of equipment		
Equipment information	Name of manufacturer	Model and power rating
	Capacity	Year of manufacture
Current status	Current location	
	Details of current commitments	
Source	Indicate source of the equipment □ Owned □ Rented □ Leased □ Specially manufactured	
The following information shall not be applicable for equipment owned by the Bidder		
Owner	Name of owner	
	Address of owner	
	Telephone	Contact name and title
	Fax	Telex
Agreements	Details of rental / lease / manufacture agreements specific to the project	

[This Table shall be used for each item of Equipment separately]

F-1
Schedule-F to Bid

ORGANIZATION CHART
FOR THE
SUPERVISORY STAFF AND LABOUR

MINIMUM MANDATORY STAFF REQUIREMENT:

The Contractor shall arrange all requisite resources for timely completion of project as per provisions given in the Bidding Documents.

Following is the list of Minimum Mandatory Staff Requirement to be deployed at site immediately by the Contractor upon commencement of Works:

Designation	Nos.	Minimum Qualification	Min. Relevant Working Experience
Project Manager	01	B.E/ B.Sc. Mechanical /Electrical Engr. with valid PEC Regd.	05 years or above
Site Engineer (Mech/Elect.)	01	B.Sc. Mechanical /Electrical Engr. with valid PEC Regd.	05 years or above
Site Supervisor (Electrical)	01	DAE (Electrical)	05 years
Site Supervisor (Mechanical)	01	DAE (Mech.)	05 years
Quantity Surveyor	01	DAE (Electrical/Mechanical)	05 years

G-1
Schedule-G to Bid

LIST OF SUBCONTRACTORS

I/ We intend to subcontract the following parts of the Work to subcontractors. In my/ our opinion,the subcontractors named hereunder are reliable and competent to perform that part of the work for which each is listed.

Enclosed are documentation outlining experience of subcontractors, the curriculum vitae and experience of their key personnel who will be assigned to the Contract, equipment to be supplied by them, size, location and type of contracts carried out in the past and a copy of valid electrical license (if applicable).

Part of Works (Give Details)	Subcontractor (With Complete Address)
1	2

H-1
Schedule-H to Bid

ESTIMATED PROGRESS PAYMENTS

Bidder's estimate of the value of work which would be executed by him during each of the periods stated below, based on his Programme of the Works and the Rates in the Bill of Quantities, expressed in thousands of PKR:

Months	Amounts (in %age of Bid Price)
1	**2**
1st	
2nd	
3rd	
4th	
5th	
6th	
7th	
8th	
9th	
10th	
11th	
12th	
Bid Price	**100%**

I-1
Schedule-I to Bid

CONSTRUCTION CAMP AND HOUSING FACILITIES

The Bidder in accordance with Clause 6 of the Conditions of Contract shall provide description of hisconstruction camp's facilities and staff housing requirements.

The Bidder shall list or explain his plans for providing these facilities for the service of the Contract asfollows:

1. Site Preparation (clearing, land preparation, etc.).
2. Provision of Services.
   a) Electrical power (expected power load, etc.).
   b) Water (required amount and system proposed).
   c) Sanitation (sewage disposal system, etc.)
3. Construction of Facilities
   a) Contractor's Office. Workshop and Work Areas (areas required and proposed layout, type ofconstruction of buildings, etc.).
   b) Warehouses and Storage Areas (area required, type of construction and layout).
   c) Housing and Staff Facilities (Plans for housing for proposed staff, layout, type of construction,etc.).
4. Construction Equipment Assembly and Preparation (detailed plans for carrying out this activity).
5. Other Items Proposed (Security services, etc.)

Note:
The Contractor shall be responsible for pumps, electrical power, water and electrical distribution systems, and sewerage system including all fittings, pipes and other items necessary for servicing the Contractor's construction camp.

J-1
Schedule-J to Bid

INTEGRITY PACT
DECLARATION OF FEES, COMMISSION AND BROKERAGE, ETC. PAYABLE BY THE BIDDERS/CONTRACTORS OF GOODS, SERVICES & WORKS IN CONTRACTS WORTH PAK. RS. 10.00 MILLION OR MORE

Contract No._____ Dated _____
Contract Value: _____
Contract Title: _____

…… [Name of Bidder/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 Pakistan (GoP) or any administrative subdivision or agency thereof or any other entity owned or controlled by GoP through any corrupt business practice.

Without limiting the generality of the foregoing, [Name of Bidder/ 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 GoP, except that which has been expressly declared pursuant hereto.

[Name of Bidder/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 GoP and has not taken any action or will not take any action to circumvent the above declaration, representation or warranty.

[Name of Bidder/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 GoP under any law, contract or other instrument, be voidable at the option of GoP.

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

Name of Employer: ……	Name of Bidder/Contractor: ……
Signature: ……..…..…	Signature: …….
[Seal]	[Seal]

K-1
Schedule-K to Bid

SPECIFIC WORKS DATA

SPECIFIC WORKS DATA HAS BEEN PRESCRIBED IN
SPECIFIC AND TECHNICAL SPECIFICATIONS OF BIDDING DOCUMENTS

Schedule-L to Bid

LIST OF RECOMMENDED MANUFACTURERS FOR ITEMS/ MATERIALS/EQUIPMENT MISCELLANOUS WORKS

List of Approved Manufacturers for Materials/Equipment, Schedule of Technical Data and Compliance sheet etc. are enclosed with related BOQs

STANDARD FORMS

BS-1

FORM OF BID SECURITY

Security Executed on _____
(Date)

Expiry on _____
(Date)

Name of Surety with Address: _____

_____

Name of Principal (Bidder) with Address _____

_____

Penal Sum of Security PKR_____(Pak Rupees _____
_____)

Bid Reference No. _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bid and at therequest of the said Principal (Bidder) we, the Surety above named, are held and firmly boundunto_____
(hereinafter called the 'Employer') in the sum stated above for the payment of which sum well andtruly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointlyand severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Bidder has submittedthe accompanying Bid dated_for _____
_____(*Particulars of Bid*) to the said Employer; and

(1) WHEREAS, the Employer has required as a condition for considering said Bid that the Bidder furnishes a Bid Security in the above said sum to the Employer, conditioned as under: that the Bid Security shall remain in force for a period fourteen (14) days beyond the Bid Validity date i.e., upto____.

(2) that the Bid Securities of the Bidders except the lowest three will be returned by the Employer within twenty eight (28) days from the opening of Bids, provided a Bidder request for the return of its Bid Security, or on the expiry of original validity of Bid Security or as extended, whichever is earlier;

(3) that the Bid Security of the lowest three Bidders comprising the successful Bidder will be returned when the successful Bidder has furnished the required Performance Security; and

(4) that in the event of failure of the successful Bidder to furnish the required Performance Security, the entire said sum be paid immediately to the said Employer pursuant to IB.16 and IB.35 of the Instructions to Bidders for the successful Bidder's failure to perform.

NOW THEREFORE, if the successful Bidder shall, within the period specified therefor, on the prescribed form presented to him for signature enter into a formal Contract with the said Employer in accordance with his Bid as accepted and furnish within twenty eight (28) days of his being requested to do so, a Performance Security with good and sufficient surety, as may be required, upon the form prescribed by the said Employer for the faithful performance and proper fulfilment of the said Contract or in the event of non-withdrawal of the said Bid within the time specified for its validity then this obligation shall be void and of no effect, but otherwise toremain in full force and effect.

BS-2

PROVIDED THAT the Surety shall forthwith pay the Employer the said sum upon first written demand of the Employer (without cavil or argument) and without requiring the Employer to prove or to show grounds or reasons for such demand, notice of which shall be sent by the Employer by registered post duly addressed to the Surety at its address given above.

PROVIDED ALSO THAT the Employer shall decide, whether the Principal (Bidder) has duly performed his obligations to sign the Contract Agreement and to furnish the requisite Performance Security within the time stated above, or has defaulted in fulfilling said requirements and the Surety shall pay without objection the said sum upon demand from the Employer forthwith and without any reference to the Principal (Bidder) or any other person.

IN WITNESS WHEREOF, the above bounden Surety has executed the instrument under its seal on the date indicated above, the name and seal of the Surety being hereto affixed and these presents duly signed by its undersigned representative pursuant to authority of its governing body.

SURETY
(Scheduled Bank)

WITNESS:

Signature _____

1. _____
_____
Corporate Secretary (Seal)

Name _____
Title _____
Corporate Guarantor (Seal)

2. _____
_____
Name, Title & Address

PS-1

FORM OF PERFORMANCE SECURITY

Guarantee No._____
Executed on _____
Expiry date _____

[Letter by the Guarantor to the Employer]

Name of Guarantor with address: _____

_____

Name of Principal (Contractor) with address:_____

_____

Penal Sum of Security (*express in words and figures*) _____

_____

Letter of Acceptance No._____Dated _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bidding Documents and above said Letter of Acceptance (hereinafter called the Documents) and at the requestof the said Principal we, the Guarantor above named, are held and firmly bound unto the _____ (hereinafter called the Employer) in the penal sum of the amount stated above for the payment of which sum well and trulyto be made to the said Employer, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has accepted theEmployer's above said Letter of Acceptance for_____ _____ (*Name of Contract*) for the _____ _____ (*Name of Project*).

NOW THEREFORE, if the Principal (Contractor) shall well and truly perform and fulfill all the undertakings, covenants, terms and conditions of the said Documents during the original terms of thesaid Documents and any extensions thereof that may be granted by the Employer, with or withoutnotice to the Guarantor, which notice is, hereby, waived and shall also well and truly perform andfulfill all the undertakings, covenants terms and conditions of the Contract and of any and all modifications of said Documents that may hereafter be made, notice of which modifications to the Guarantor being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue till all requirements of Clause11, Defects After Taking Over, of Conditions of Contract are fulfilled.

Our total liability under this Guarantee is limited to the sum stated above and it is a condition of anyliability attaching to us under this Guarantee that the claim for payment in writing shall be received by us within the validity period of this Guarantee, failing which we shall be discharged of our liability, ifany, under this Guarantee.

We,_____ (the Guarantor), waiving all objections and defense under the Contract, do hereby irrevocably and independently guarantee to payto the Employer without delay upon the Employer's first written demand without cavil or arguments and without requiring the Employer to prove or to show grounds or reasons for such demand any sumor sums up to the amount stated above, against the Employer's written declaration that the Principalhas refused or failed to perform the obligations under the Contract which payment will be effected by the Guarantor to Employer’s designated Bank & Account Number.

PS-2

PROVIDED ALSO THAT the Employer shall decide, whether the Principal (Contractor) has dulyperformed his obligations under the Contract or has defaulted in fulfilling said obligations and theGuarantor shall pay without objection any sum or sums up to the amount stated above upon first written demand from the Employer forthwith and without any reference to the Principal or any otherperson.

IN WITNESS WHEREOF, the above-bounden Guarantor has executed this Instrument under its sealon the date indicated above, the name and corporate seal of the Guarantor being hereto affixed andthese presents duly signed by its undersigned representative, pursuant to authority of its governingbody.

Guarantor
(Scheduled Bank)

WITNESS:

Signature _____

1. _____
_____
Corporate Secretary (Seal)

Name _____
Title _____
Corporate Guarantor (Seal)

2. _____
_____
Name, Title & Address

Letter of Acceptance
[letter head paper of the Employer]

NAME OF CONTRACT:_____

CONTRACT NUMBER:_____

To :_____

Date:_____

Your Reference:_____

Our Reference:_____

We thank you for your Bid dated _____ for the execution and completion of the Works comprising the above-named Contract and remedying of defects therein, all in conformity with the terms and conditions contained in the Contract.

We have pleasure in accepting your Bid for the Accepted Contract Amount of:

_____
[currency and amount in figures]

_____
[currency and amount in words]

In consideration of you properly and truly performing the Contract, we agree to pay you the Accepted Contract Amount or such other sums to which you may become entitled under the terms of the Contract, at such times and as prescribed by the Contract.

We acknowledge that this Letter of Acceptance creates a binding Contract between us, and we undertake to fulfil all our obligations and duties in accordance with the terms of this Contract.

Signature:_____

Signed by: _____

For and on behalf of:_____

Date:_____

CA-1

FORM OF CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT (hereinafter called the "Agreement") made on the ____ day of _____ (month) 2025 between _____ _____(hereinafter called the "Employer") ofthe one part and_____(hereinafter called the"Contractor") of the other part.
WHEREAS the Employer is desirous that certain Works, viz.,_____ _____ should be executed by the Contractor and has acceptеda Bid by the Contractor for the execution and completion of such Works and the remedying of anydefects therein.

NOW this Agreement witnessed 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 hereinafter referred to.

2. The following documents, in the order of priority, after incorporating addenda, if any, except those parts relating to Instructions to Bidders shall be deemed to form and be read and construedas part of this Agreement:

   a) This Contract Agreement;
   b) The Letter of Acceptance;
   c) The Letters of Bid (Letter of Technical Bid & Letter of Price Bid);
   d) The Particular Conditions Part A - Contract Data;
   e) The Particular Conditions Part B - Special Provisions;
   f) The General Conditions;
   g) The Specifications Part A - Specific Provisions;
   h) The Specifications Part B - Technical Provisions;
   i) The Drawings;
   j) The Completed Schedules to Bid including Schedule of Prices;
   k) the JV Undertaking (if the Contractor is a JV); and
   l) *[Employer to insert any other documents forming part of the Contract*]

   The addenda/corrigenda, if any, (Excluding part relating to Instructions to Bidders alongwith Bidding Data) shall be deemed to have been incorporated at the appropriate places in the "Documents forming the Contract".

3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy defects therein in conformity and in all respects with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor, in consideration of the execution and completion of the Works as per provisions of the Contract, the Contract Price or such other sumas 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 on the day,month and year first before written in accordance with their respective laws.

Signature of Contractor	Signature of Employer
(Seal)	(Seal)

Signed, Sealed and Delivered in the presence of:

Witness	Witness
(Name, Title and Address)	(Name, Title and Address)

DAAB-1

DAAB Agreement

[*All italicised text and any text within square brackets (except sub-clause headings) in this formof agreement is for use in preparing the form and should be deleted from the final product*].

Name and details of the Contract _____

_____

This Agreement made the____day of_____[*month*],_____[*year*], between

Name and contact details of the Employer _____ (name)
_____ (*address*)

_____ (*telephone*)

_____(*email / other contact details*);

Name and contact details of the Contractor _____ (name)
_____ (*address*)

_____(*telephone*)

_____(*email / other contact details*);

Name and contact details of the DAAB Member _____ (name)

_____(*address*)

_____ (*telephone*)

_____(*email / other contact details*);

("**DAAB Agreement**")

Whereas:

A. the Employer and the Contractor have entered (or intend to enter) into the Contract;

B. under the Contract, the "**DAAB**" or "**Dispute Avoidance/Adjudication Board**" means the sole member or three members (as stated in the Contract Data of the Contract) so named in the Contract, or appointed under Sub-Clause 21.1 [*Constitution of the DAAB*] orSub-Clause 21.2 [*Failure to Appoint DAAB Members*] of the Conditions of Contract;

C. the Employer and the Contractor desire jointly to appoint the above-named DAAB Member to act on the DAAB as:

   a. the sole member of the DAAB, and where this is the case, all references to the "Other Members" do not apply; or
   b. one of three members / chairman [*delete the one which is not applicable*] of the DAAB and, where this is the case, the other two persons are:

DAAB-2

_____ *(name)*	_____ *(name)*
_____ *(address)*	_____ *(address)*
_____*(telephone)*	_____*(telephone)*
_____*(email/ other contact details)*	_____ *(email/ other contact details)*

the "**Other Members**"; and

D. the DAAB Member accepts this appointment.

The Employer, Contractor and DAAB Member jointly agree as follows:

1. The conditions of this DAAB Agreement comprise:

   (a) Clause 21 [*Disputes and Arbitration*] of the Conditions of Contract, and any other provisions of the Contract that are applicable to the DAAB's Activities; and

   (b) the "General Conditions of Dispute Avoidance/Adjudication Agreement", which is appended to the General Conditions of the "Conditions of Contract for Construction"Second Edition 2017 published by FIDIC ("GCs"), as amended and/or added to by the following provisions.

2. [Details of amendments to the GCs, if any. For example:

   In the procedural rules annexed to the GCs, Rule _ is deleted and replaced by: " … "]

3. The DAAB Member shall be paid in accordance with Clause 9 of the GCs. The currencyof payment shall be____.
   In respect of Sub-Clauses 9.1 and 9.2 of the GCs, the amounts of the DAAB Member'smonthly fee and daily fee shall be:
   monthly fee_____per month,
   anddaily fee of_____per day
   (or as otherwise set under Sub-Clause 9.3 of the GCs).

4. In consideration of the above fees, and other payments to be made to the DAAB Member in accordance with the GCs, the DAAB Member undertakes to act as DAAB Member in accordance with the terms of this DAAB Agreement.

5. The Employer and the Contractor shall be jointly and severally liable for the DAAB Member's fees and other payments to be made to the DAAB Member in accordance with the GCs.

6. This DAAB Agreement shall be governed by the law of_____(if not stated, the law that governs the Contract under Sub-Clause 1.4 of the Conditions of Contract).

DAAB-3

SIGNED by:_____	SIGNED by:_____	SIGNED by:_____
Print name:_____	Print name:_____	DAAB Member
Title:_____	Title:_____	
for and on behalf of theEmployer	for and on behalf of theContractor	Title:_____
in the presence of	in the presence of	in the presence of
Witness:_____	Witness:_____	Witness:_____
Name:_____	Name:_____	Name:_____
Address:_____	Address:_____	Address:_____
Date:_____	Date:_____	Date:_____

MG-1

FORM OF MOBILIZATION ADVANCE GUARANTEE

Guarantee No._____Date _____
WHEREAS_____(hereinafter called the 'Employer')
has entered into a Contract for _____
(Particulars of Contract) with_____(hereinafter called the "Contractor').

AND WHEREAS, the Employer has agreed to advance to the Contractor, at the Contractor's request, an amount of Pak Rupees_____(PKR_____)
which amount shall be advanced to the Contractor as per provisions of the Contract.

AND WHEREAS, the Employer has asked the Contractor to furnish Guarantee to secure the mobilization advance for the performance of his obligations under the said Contract.

AND WHEREAS, _____
(hereinafter called the "Guarantor") at the request of the Contractor and in consideration of the Employer agreeing to make the above advance to the Contractor, has agreed to furnish the said Guarantee.

NOW, THEREFORE, the Guarantor hereby guarantees that the Contractor shall use the advance for the purpose of above mentioned Contract and if he fails and commits default in fulfilment of any of his obligations for which the advance payment is made, the Guarantor shall be liable to theEmployer for payment not exceeding the aforementioned amount.

Notice in writing of any default, on the part of the Contractor, of which the Employer at his discretion of making decision, shall be given by the Employer to the Guarantor, and on such first written demand, payment shall be made by the Guarantor of all sums then due under this Guarantee without any reference to the Contractor and without any objection.

This Guarantee shall remain in force until the advance is fully adjusted against payments from theInterim Payment Certificates of the Contractor or until_____
_____whicheveris earlier. *(Date)*

The Guarantor's liability under this Guarantee shall not in any case exceed the sum of PKR _____(Pak Rupees _____).

This Guarantee shall remain valid up to the aforesaid date and shall be null and void after the aforesaid date or earlier if the advance made to the Contractor is fully adjusted against payments from Interim Payment Certificates of the Contractor provided that the Guarantor agrees that the aforesaid period of validity shall be deemed to be extended if on the abovementioned date the advance payment is not fully adjusted.

Guarantor
(*Scheduled Bank*)

WITNESS:
1. _____
_____
Corporate Secretary (Seal)
2. _____
_____
Name, Title & Address

Signature _____
Name _____
Title _____
Corporate Guarantor (Seal)

CONDITIONS OF CONTRACT

CONDITIONS OF CONTRACT

The Conditions of Contract comprise two parts:

(a) General Conditions
(b) Particular Conditions

General Conditions

These Conditions are the “General Conditions” which form part of the “FIDIC Conditions of Contractfor Construction for Building and Engineering Works Designed by the Employer Second Edition (2017 Red book, Reprinted 2022 with amendments)” published by:

International Federation of Consulting Engineers
(Fédération Internationale des Ingénieurs – Conseils) –
(FIDIC)World Trade Center II - Geneva Airport
P. O. Box 311
CH-1215 Geneva
15Switzerland
Email: fidic@fidic.org, fidic.pub@fidic.org
Website: https://fidic.org/bookshop

Particular Conditions

The Particular Conditions (PC) complement the General Conditions (GC) to specify dates, contractual requirements, and special circumstances related to the Works. The PC consists of two parts, Part A - Contract Data and Part B - Special Provisions. The provisions to be found in the Special Provisions (Particular Conditions - Part B) take precedence over the equivalent provisionsfound under the same Sub-Clause number(s) in the General Conditions, and the provisions of the Contract Data (Particular Conditions - Part A) take precedence over the Special Provisions (Particular Conditions - Part B).

Part A - Contract Data

Sub-Clause	Data to be Given	Data
1.1.27	Defects Notification Period (DNP):	1095 days
1.1.31	Employer's name and address:	**Project Director** Sindh Forensic Science Laboratory at Karachi
1.1.35	Engineer's name and address:	National Engineering Services Pakistan (Pvt.) Limited (NESPAK) 4th Floor, NICL Building, Shahra-e-Faisal, Karachi
1.1.73	Sections:	• Fire Fighting FM 200 (BOQ Code A-1) • Energy Monitoring, Diesel Generator & Allied Works (BOQ Codes B-1 & B-2) • HVAC ducting works (BOQ Code C-1) • ELV System & Other Works (BOQ Codes D-1 to D-18) • Cargo Elevator Works (BOQ Code E-1)
1.1.84	Time for Completion:	365days for the whole of the Works • Firefighting FM 200 - 120 days • Energy Monitoring, Diesel Generator & Allied Works - 180 days • HVAC Ducting – 365 days • ELV system & other works – 365 days • Cargo Elevator - 120 days
1.3(a)(ii)	agreed methods of electronic transmission:	For Notices, electronic transmission is not permitted. For other communications, SMS, Email, WhatsApp, or any other such means used by the Employer required for supplementing pace of work/decision making for timely completion of the Project.
1.3(d)	address of Employer for communications:	As stated hereof in Sub-Clause 1.1.31
	address of Engineer for communications:	As stated hereof in Sub-Clause 1.1.35

Sub-Clause	Data to be Given	Data
	address of Contractor for communications:	[To be filled in at the time of signing of the Contract]
1.4	Contract shall be governed by the law of:	Islamic Republic of Pakistan
	ruling language:	English
	language for communications:	English
2.1	after receiving the Letter of Acceptance, the Contractor shall be given right of access to all or part of the Site within:	No later than the Commencement Date
2.4	Employer's financial arrangements	The Employer's financial arrangements are in well in place and payments under the Contract shall be made effectively.
3.2 (e)(ii)	Engineer's Duties and Authority	Variation resulting in an increase of the Accepted Contract Amount in excess of one percent (1%) subject to accumulative Variations not exceeding five percent (5%) of the Accepted Contract Amount
4.2	Performance Security (as percentage of the Accepted Contract Amount in Currencies) percent: currency:	Ten percent (10%) denominated in PKR or in a freely convertible currency acceptable to the Employer.
4.2.1	List of Insurance Companies	Any AA rated company from PACRA/VIS
4.7.2	period for notification of errors in the items of reference	Twenty Eight (28) days
4.19	period of payment for temporary utilities	None
4.20	number of additional paper copies of progress reports	Three (03)
5.1(a)	maximum allowable accumulated value of work subcontracted (as a percentage of the Accepted Contract Amount)	None
5.1(b)	parts of the Works for which subcontracting is not permitted	None
6.5	Normal working hours on the Site	12 Hours/Day
8.3	number of additional paper copies of programmes	Three (03)

Sub-Clause	Data to be Given	Data
8.8 & 14.15(b)	Delay Damages payable for eachday of delay	*0.25% of the Accepted Amount Specific Section(s) for delay in completion of such Works. **(% shall be calculated in such a way that max LD be deducted in 1/3 duration of the completion period of specific section)*
8.8	maximum amount of Delay Damages	Ten percent (10%) of Accepted Amount Specific Section(s).
8.14	Applicability of Incentives for Early Completion	None
12.3	Percentage profit	None
13.4.(b)(ii)	percentage rate to be applied to Provisional Sums for overhead charges and profit	None
14.2	Total Advance Payment	Ten percent (10%) of the Accepted Contract Amount excluding Provisional Sums.
14.2.3	percentage deductions for the repayment of the Advance Payment	Deduction shall be made at the amortization rate of 17.5 % of the value of the Works executed of each IPC as provided in paragraph (i) of Sub-Clause GCC 14.3, starting from 2nd IPC provided that the advance payment shall be completely repaid prior to the time when 90% of the Accepted Contract Amount less Provisional Sums has been certified forpayment. It may be more than 17.5% in the last installment to ensure full repayment.
14.3	period of payment	one month
14.3(b)	number of additional paper copiesof Statements	Four (04)
14.3 (iii)	percentage of retention	Five percent (5%)
14.3 (iii)	limit of Retention Money (as a percentage of the Contract Price)	Five percent (5%)
14.5(b)(i)	Plant and Materials for payment when shipped	Not Used
14.5(c)(i)	Plant and Materials for payment when delivered to the Site	Not Used

Sub-Clause	Data to be Given	Data
14.6.2	minimum amount of InterimPayment Certificate (IPC)	Rs. 80 Million
14.7(a)	period of payment of Advance Payment to the Contractor	14 days
14.7b(i)	period for the Employer to make interim payments to the Contractor under Sub-Clause 14.6 [InterimPayment]	28 Days
14.7b(ii)	period for the Employer to make interim payments to the Contractor under Sub-Clause 14.13 (Final Payment)	28 days
14.7(c)	period for the Employer to makefinal payment to the Contractor	56 days
14.8	financing charges for delayed payment	Not Used.
14.11.1(b)	number of additional paper copiesof draft Final Statements	three (03)
14.15	currencies of payment of Contract Price	PKR only
14.15(a)(i)	Proportions or amounts of Localand Foreign currencies	Only local currency, i.e., PKR. Foreign Currency is not applicable.
14.15(c)	currencies and proportions forpayment of Delay Damages	PKR only
14.15(f)	rates of exchange	Not Applicable

Sub-Clause	Data to be Given	Data
17.2(d)	forces of nature, the risks of whichare allocated to the Contractor	Nil
19.1	permitted deductible limits: **i)** insurance required for theWorks ii) insurance required for Goods iii) insurance required for liability for breach of professional duty iv) insurance required against liability for fitness for purpose (if any is required) v) insurance required for injury to persons and damage to property vi) insurance required for injuryto employees vii) other insurances required byLaws and by local practice	i) Ten percent (10%) of loss amounton each & every loss ii) Nil iii) Nil iv) Nil v) Nil vi) Nil vii) Nil
19.1	Periods for submission ofinsurance: a) evidence of insurance b) relevant policies	Not later than the CommencementDate Within twenty eight (28) days from theCommencement Date
19.2.1(b)	additional amount to be insured (as a percentage of the replacement value)	15% of the replacement value of the Accepted Contract Amount
19.2.2	extent of insurance required forGoods amount of insurance required forGoods	from Ex-Works (i.e., works, factory, warehouse, etc) to delivery at the Site Full replacement value
19.2.3(a)	amount of insurance required for liability for breach of professional duty	Full replacement value of the Works tobe designed by the Contractor
19.2.3(b)	insurance required against liabilityfor fitness for purpose	Yes
19.2.3	period of insurance required for liability for breach of professional duty	Until the date of issuance of Performance Certificate

Sub-Clause	Data to be Given	Data
19.2.4	amount of insurance required for injury to persons and damage to property	Injury to person and Fatal case:in accordance with Workmen Compensation Act Damage to Property: 2,000,000 without limit to the number ofincidents
19.2.6	other insurances required by Lawsand by local practice	All insurances as applicable, to the extent of execution of the project, under Federal and Provincial laws ofIslamic Republic of Pakistan
21.1	time for appointment of the DAAB	Appointment of the DAAB shall be made when Dispute arises between the Parties.
21.1	the DAAB shall comprise	Sole Member
21.1	List of proposed members ofDAAB - proposed by Employer - proposed by Contractor	*[to be inserted at the time of signing ofthe Contract]* 1._____ 2._____ 1._____ 2._____
21.2	Appointing entity (official) forDAAB members	Chairman Pakistan Engineering Council (PEC) from the list of PEC approved arbitrators published at its website
21.6	Rules of Arbitration	Pakistan Arbitration Act of 1940. The place of Arbitration shall be: **Karachi (Pakistan)**

Particular Conditions

Part B - Special Provisions

1.1 Definitions

1.1.76 "Specification"

Following is added at the end:

"and consists of two parts i.e.,
i) "Part A - Specific Provisions"; and
ii) "Part B - Technical Provisions"."

1.2 Interpretation

"and" is deleted from the end of sub-paragraph (i) and added at the end of sub-paragraph (j).

Sub-paragraph (k) is added:

"(k) The word "tender" is synonymous with "bid" the word tenderer with "bidder", the words "tender documents" with "bidding documents" and "Schedule of Prices" with "Bill of Quantities", as applicable."

1.5 Priority of Documents

The documents listed at (a) through (k) of this Sub-Clause aredeleted and substituted with the following:

(a) the Contract Agreement;
(b) the Letter of Acceptance;
(c) the Letter of Bid;
(d) the Particular Conditions Part A - Contract Data;
(e) the Particular Conditions Part B - Special Provisions;
(f) the General Conditions;
(g) the Specification Part A - Specific Provisions;
(h) the Specification Part B - Technical Provisions;
(i) the Drawings;
(j) the completed Schedules to Bid including Bill ofQuantities;
(k) the JV Undertaking (if the Contractor is a JV); and
(l) any other documents forming part of the Contract.

The addenda/corrigenda, if any, shall be deemed to have been incorporated at the appropriate places in the documents forming the Contract.

1.6 Contract Agreement

In the last line of the 1st paragraph the text "shall be borne by the Employer" is substituted by "shall be reimbursed by the Employer to the Contractor".

3.1 The Engineer

In sub-paragraph (a) the text "as defined in the Pakistan Engineering Council Act, 1975 (Act No. V of 1976)" are addedafter the words "professional engineer".

3.2 Engineer's Duties and Authority

The Engineer shall obtain the consent in writing of the Employerbefore taking action under the following Sub-Clauses of these Conditions:

(a) Consenting to the subcontracting of any part of the Works under Sub-Clause 5.1 [Subcontractors]

(b) Any action under Sub-Clauses 8.9 [Employer's Suspension]and 8.12 [Prolonged Suspension]

(c) Issuance of "Taking Over Certificate" under Sub-Clause 10.1 [Taking Over the Works and Sections].

(d) Issuing the "Performance Certificate" under Sub-Clause 11.9 [Performance Certificate].

(e) Sub-Clause 13.1 [Right to Vary]: instructing a Variation, except;

(i) in an emergency situation as determined by the Engineer, or
(ii) if such a Variation would increase the Accepted Contract Amount by less than the percentage specified in the Contract Data.

(f) Sub-Clause 13.3 [Variation Procedure]: approving a proposal for Variation submitted by the Contractor in accordance with Sub-Clause 13.3.2 [Variation by Request for Proposal] or 13.2 [Value Engineering].

(g) Certifying release of second half of the Retention Money under Sub-Clause 14.9 [Release of Retention Money].

(h) Issuing Final Payment Certificate under Sub-Clause 14.13 [Issue of FPC]

Any such requirement shall not be applied to any action by the Engineer under Sub-Clause 3.7 [Agreement or Determination], as stated in Sub-Clause 3.2 [Engineer's Duties and Authority] of the General Conditions.

Notwithstanding the obligation, as set out above, to obtain approval, if, in the opinion of the Engineer, an emergency occurs affecting the safety of life or of the Works or of adjoining property, he may, without relieving the Contractor of any of his duties and responsibility under the Contract, instruct the

Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk. The Contractor shall forthwith comply, despite the absence of approval of the Employer, with any such instruction of the Engineer. The Engineer shall determine an addition to the Contract Price, in respect of such instruction, in accordance with Clause 13 and shall notify the Contractor accordingly, with a copy to the Employer.

Following is added after the words "the Employer's consent is required" in 4th paragraph:

"stating that the Employer's consent has been obtained for that specified authority".

4.2 Performance Security

4.2.1 Contractor's Obligations

The entity issuing the Performance Security and its form shall beas under:

The Performance Security shall be, at the option of the Contractor, issued in the prescribed form included in the Bidding Documents, by (a) a Scheduled Bank in Pakistan or (b) a foreign bank duly counter-guaranteed by a Scheduled Bank in Pakistan or (c) an Insurance Company AA Rated listed in the Contract Data and rated by PACRA/VIS. In case of Joint Venture, the Performance Security shall be in thename of the Joint Venture or in the name of Lead/either firm of the JV or in ratio of shares of the individual JV partners.

Following paragraph is added at the end of this Sub-Clause:
"The amount of Performance Security shall be reduced to 50% following issue of the Taking-Over Certificate for the whole of the Works under Clause 10 of Conditions of Contract."

4.3 Contractor's Representative

In second paragraph the text "professional engineer as defined inthe Pakistan Engineering Council Act, 1975 (Act No. V of 1976)(having temporary licence in case of foreign engineer underSection 12 of the Pakistan Engineering Council Act, 1975 (Act No. V of 1976)" are added after the words "qualified, experienced".

In the 3rd paragraph the words "28 days" are substituted by "14 days". In 2nd line of 4th paragraph the text "or appoint a replacement" is substituted by "except appointment of a suitable temporary replacement is deployed at the Site"

4.4 Contractor's Documents

4.4.2 As-Built Records

First paragraph is deleted and the text in the last paragraph is substituted with the following:

"The Contractor shall furnish to the Engineer 6 copies, one reproducible and one electronic copy (provided the Engineer has made available to the Contractor editable form of the Drawings) of all Drawings amended to conform to the Works asbuilt. In case the Engineer does not make available to the Contractor editable form of the Drawings, the Contractor shall furnish to the Engineer as-built data for incorporation in the Drawings. Upon receipt of PDF versions of the as-built drawings prepared by the Engineer, the Contractor shall furnish to the Engineer 6 copies and one reproducible of these Drawings.

The price of such Drawings shall be deemed to be included in the Contract Price."

Following Sub-Clause is added:

4.4.4 Shop Drawings

The Contractor shall submit to the Engineer for review 3 copiesof all shop and erection drawings applicable to this Contract as per provision of relevant Sub-Clause of the Contract.

Review and approval by the Engineer shall not exceed 21 days and be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory and the Engineer's review or approval shall not relieve the Contractor of any of his responsibilities under the Contract.

4.8 Health and Safety Obligations

The following text is added at the end of this Sub-Clause:
In the event of work being carried out outside the normal working hours and in the event of work being carried out at night, the Contractor shall at his own cost, provide and maintain such good and sufficient light as will enable the work to proceed satisfactorily and without danger. The approaches to the Site andthe Works where the night work is being carried out shall be sufficiently lighted. All arrangement adopted for such lighting shall be to the satisfaction of the Engineer.

4.20 Progress Reports

At the end of sub-paragraph (g) the word "and" is deleted and at the end of sub-paragraph (h) the full stop (.) is replaced with ";", and the following new sub-paragraphs are added as:

(i) planned programme for the execution of the Works for next 56 days to enable the Engineer to determine its programme of inspection and testing;

(j) monthly summery of daily job record indicating weather conditions, deployment of Contractor's Equipment, labour employment, local material procurement and material import, if any; and

(k) salient contractual and project information.

5.1 Subcontractors

Add the following text at the end of paragraph (ii): "under Schedule to Bid"

The following is added at the end of the last paragraph of Sub- Clause 5.1:

"All subcontracts relating to the Works shall include provisions which entitle the Employer to require the subcontract to be assigned to the Employer under sub-paragraph (a) of Sub- Clause 15.2.3 [*After Termination*].

The Contractor shall give reasonable opportunity to contractors from Islamic Republic of Pakistan for subcontracts for the Works, and endeavor to employ such contractors as Subcontractors."

5.2 Nominated Subcontractors

5.2.2 Objection to Nomination

In sub-paragraph (c), "and" is deleted from the end of (i);"." at the end of (ii) is replaced with: ", and".

The following is then added as (iii):

"(iii) be paid only if and when the Contractor has received from the Employer payments for sums due under the Subcontract referred to under Sub-Clause 5.2.3 [*Payment to nominated Subcontractors*]."

6.1 Engagement of Staffand Labour

The following paragraph is added at the end of the Sub-Clause:

"The Contractor shall, to the extent practicable and reasonable, employ staff (not less than 50%) and labour (not less than 85%) with appropriate qualifications and experience from sources within the Islamic Republic of Pakistan."

6.7 Health and Safety of Personnel

The existing text is substituted with the following:

"In order to provide for the safety, health and welfare of persons, and for prevention of damage of any kind, all operations for the purposes of or in connection with the Contract shall be carried out in compliance with the Safety Requirements of the Government of Pakistan with such modifications thereto as the Engineer may authorize or direct and the Contractor shall take or cause to be taken such further measures and comply with such further requirements as the Engineer may determine to be reasonably necessary for such purpose. The Contractor shall also provide all other medical services and appoint a health and safety officer at Site if stated in the Specifications. In case of any fatality or serious accident, the Contractor shall, in addition, notify the Engineer immediately by the quickest available means."

6.8 Contractor's Superintendence

Insert at the end of sub-paragraph (a) of this Sub-Clause:

"or, if not, the Contractor shall make competent interpreters available during all working hours, in a number sufficient for those persons to properly perform their superintendence duties"

The following text is added at the end of this Sub-Clause:

"The Contractor's authorized representative and his other engineers working at site shall possess valid registration with the Pakistan Engineering Council.

The Contractor's authorized representative at Site shall be authorized to exercise adequate administrative and financial powers on behalf of the Contractor so as to achieve completion of the Works as per the Contract."

6.12 Key Personnel

The following is inserted at the end of the last paragraph:

"If any of the Key Personnel are not fluent in this language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer."

The following Sub-Clauses 6.13 to 6.26 are added at the end of Sub-Clause 6.12:

6.13 Foreign Personnel

The Contractor may bring in to the Country any foreign personnel who are necessary for the execution of the Works to the extent allowed by the

applicable Laws. The Contractor shall ensure that these personnel are provided with the required residence visas and work permits. The Employer will, if requested by the Contractor, use all reasonable endeavor in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national, or government permission required for bringing in the Contractor's personnel.

The Contractor shall be responsible for the return of these personnel to the place where they were recruited or to their domicile. In the event of the death in the Country of any of these personnel or members of their families, the Contractor shall similarly be responsible for making the appropriate arrangements for their return or burial.

6.14 Supply of Foodstuffs

The Contractor shall arrange for the provision of a sufficient
supply of suitable food as may be stated in the Specification at reasonable prices for the Contractor's Personnel for the purposes of or in connection with the Contract.

6.15 Supply of Water

The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel.

6.16 Measures against Insect and Pest Nuisance

The Contractor shall at all times take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce the danger to their health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide.

6.17 Alcoholic Liquor or Drugs

The Contractor shall not, otherwise than in accordance with the Laws of the Country, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or allow importation, sale, gift, barter or disposal thereto by Contractor's Personnel.

6.18 Arms and Ammunition

The Contractor shall not give, barter, or otherwise dispose of, to any person, any arms or ammunition of any kind, or allow Contractor's Personnel to do so.

6.19 Festivals and Religious Customs

The Contractor shall respect the Country's recognized festivals, days of rest and religious or other customs.

6.20	**Funeral Arrangements**	The Contractor shall be responsible, to the extent required by local regulations, for making any funeral arrangements for any of its local employees who may die while engaged upon the Works
6.21	**Forced Labour**	The Contractor, including its Subcontractors, shall not employ or engage forced labour which consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements.
6.22	**Child Labour**	The Contractor, including its Subcontractors, shall not employ or engage child labour in accordance with relevant law(s) in force in Islamic Republic of Pakistan.
6.23	**Employment Records of Workers**	The Contractor shall keep complete and accurate records of the employment of labour at the Site. The records shall include the names, ages, genders, hours worked and wages paid to all workers. These records shall be summarized on a monthly basis and submitted to the Engineer. These records shall be included in the details to be submitted by the Contractor under Sub-Clause 6.10 [*Contractor's Records*].
6.24	**Workers' Organizations**	The Contractor shall comply with the relevant labour laws of Pakistan which recognize workers' rights to form and to join workers' organizations/Trade Union of their choosing and to bargain collectively without interference.
6.25	**Non-Discrimination and Equal Opportunity**	The Contractor shall not make decisions relating to the employment or treatment of Contractor's Personnel on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment of Contractor's Personnel on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to any aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job assignment, promotion, termination of employment or retirement, and disciplinary practices. Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job shall not be deemed discrimination. The Contractor shall provide protection and assistance

as necessary to ensure nondiscrimination and equal opportunity, including for specific groups such as women, persons with disabilities, migrant workers and children (of working age in accordance with Sub-Clause 6.22).

6.26 Epidemics

In the event of any out-break of illness of epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Government or the local medical or sanitary authorities for the purpose of overcoming the same.

7.7 Ownership of Plant and Materials

The following is added before the first paragraph: "Except as otherwise provided in the Contract,"

The following is added at the end of the Sub-Clause:

"No Plant and/or Materials that is the property of the Employershall be removed from the Site. If it becomes necessary to:

(i) remove any item of such Plant from the Site for the purposes of repair, the Contractor shall give a Notice, with reasons, to the Engineer requesting consent to remove the defective or damaged item off the Site. This Notice shall clearly identify the item of defective or damaged Plant, and shall give details of: the defect or damage to be repaired; the place to which defective or damaged item of Plant is to be taken for repair; the transportation to be used (and insurance cover for such transportation); the proposed inspections and testing off the Site; and the planned duration required before the repaired item of Plant shall be returned to the Site. The Contractor shall also provide any further details that the Employer may reasonably require; or

(ii) replace any item(s) of such Plant and/or Materials, the Contractor shall give a Notice, with reasons, to the Engineer clearly identifying the item(s) of Plant and/or Materials tobe replaced, and giving details of the due date of delivery to the Site of the replacement item(s).

Where any item of Plant and/or Materials has become the property of the Employer under this Sub-Clause before it has been delivered to the Site, the Contractor shall ensure that such an item is not moved except for its delivery to the Site.

The Contractor shall indemnify and hold the Employer harmless against and from the consequences of any defect in title or encumbrance or charge (except any reasonable restriction arising from the intellectual property rights of the manufacturer or producer) on any item of Plant and/or Materials that has become the property of the Employer under this Sub-Clause."

7.9 Use of Pakistani Materials and Services

The Contractor shall, so far as may be consistent with the Contract, make the maximum use of materials, supplies, plant and equipment indigenous to or produced or fabricated in Pakistan and services available in Pakistan provided such materials, supplies, plant, equipment and services shall be of required standard.

8.1 Commencement of Works

The following is added before the first paragraph:

"After signing of the Contract Agreement by both Parties," and thereafter the word "The" is replaced with the word "the".

8.5 Extension of Time for Completion

The following is added after paragraph (c):
"for last five years".

The following Sub-Clause 8.14 is added after Sub-Clause 8.13:

8.14 Incentives For EarlyCompletion

If Contract Data does not state applicability of incentives for early completion, this Sub-Clause shall not apply.

The Contractor shall be entitled subject to Sub-Clause 20.2 [*Claims for Payment and/or EOT*] to bonus payment if the Works and/or each Section is completed earlier than the Time for Completion for the Works or Section (as the case may be). The amount of bonus for early completion of the Works and/or each Section shall be upto a limit and at a rate to 50% of the relevant limit and rate of delay damages prescribed in Contract Data and shall be paid for every day which shall elapse between the relevant Date of Completion of the Works or Section and therelevant Time for Completion.

For the purposes of calculating any bonus payment, the applicable Time for Completion stated in the Contract Data is fixed and no adjustments of this time by reason of granting an EOT will be allowed.

The following Sub-Clause 11.12 is added after Sub-Clause 11.11:

11.12	**Supervisory Assistance During DNP**	If provided under the Schedule of Prices, the Contractor shall provide supervisory assistance to the Employer during the DNP for the Works. Such supervisory assistance shall be as described in the Specification for the purpose of supporting the Employer's operation and maintenance of the Plant for the period specified in the Schedule of Prices after the Date of Completion.
12.2	**Method of Measurement**	The following paragraph is added at the end of the Sub-Clause: "Summary of measured quantity for payment shall be delineated item-wise under four heads namely; "Schedule of Prices Quantity", "Quantity Executed To-date", "Quantity Certified Previously" and "Net Quantity Executed under this Certificate".
12.3	**Valuation of the Works**	The following text is added at the end of fifth paragraph of the Sub-Clause: "Sum of overhead charges and profit for sub-paragraph (a) shall be Twenty percent (20%)".
13.4	**Provisional Sums**	The following paragraph is inserted as the penultimate paragraph: "The Provisional Sum shall be used to cover the Employer's share of the DAAB members' fees and expenses, in accordance with Clause 21. No prior instruction of the Engineer shall be required with respect to the work of the DAAB. The Contractor shall submit the DAAB members' invoices and the satisfactory evidence of having paid 100% of such invoices as part of the substantiation of those Statements submitted under Sub-Clause 14.3.
13.6	**Adjustments for Changes in Laws**	The following paragraph is added at the end of the Sub-Clause: "Notwithstanding the foregoing, the Contractor shall not be entitled to an extension of time if the relevant delay has already been taken into account in the determination of a previous extension of time and such Cost shall not be separately paid ifthe same shall already have been taken into account in the indexing of any inputs to the Table of Adjustment Data in accordance with the provisions of Sub-Clause 13.7 [*Adjustments for Changes in Cost*]."

14.2 Advance Payment

14.2.1 Advance Payment Guarantee

The entity issuing the Advance Payment Guarantee and its form shall be as under:

The Advance Payment Guarantee shall be in the form of Guarantee issued by (a) a Scheduled Bank in Pakistan or (b) a foreign bank duly counter-guaranteed by a Scheduled Bank in Pakistan.

In case of Joint Venture, the Advance Payment Guarantee(s) shall be in the name of the Joint Venture or in the name of Lead/either firm of the JV or in ratio of shares of the individual JV partners.
14.2.1 Advance Payment Guarantee.

14.4 Schedule of Payments

The Contract Price shall be paid according to the following Schedule of Payments:

A) Payment against Supply, Installation, Testing and Commissioning of Plant and Materials imported from abroad shall be made in the following manner:

1. Ten percent (10%) recoverable advance shall be paid against the submission of acceptable bank guarantee. The bank Guarantee shall be released after recovery of advance from IPC's.

2. Twenty percent (20%) of the Contract value shall be paid after approval of its technical submittals by the Engineer and upon submission of Letter of Credit (L/C) (in original) established by the Contractor for payment to the Manufacturer. The charges for the establishment of such L/C (i.e., opening and retirement) and subsequent charges for modifications and extension shall be borne by the Contractor.

3. Thirty percent (30%) of the Contract value shall be paid upon submission of the following documents:

   - Notice to deliver, issued by the Engineer after pre-shipment inspection at Manufacturer's Premises, up to satisfaction of the Engineer.

   - Shipping Documents comprising:
     i. Payment/Commercial Invoice duly certified by the Engineer;
     ii. Clean on board Bill of Landing or airway Bill issued by freight forwarder;
     iii. Warranty Certificate issued by the Manufacturer;

iv. Certificate or Policy of Marine Insurance covering transit insurance from Ex-works to the Project Site of the portion of the Plant and Materials for which Certificate of Payment is requested;
v. Packing List;
vi. Certificate of Origin (in original), issued by the Manufacturer;
vii. Pre-shipment Inspection Report (if applicable), issued by the Engineer or any third party approved by the Employer; and
viii. Any other document as necessary due to statutory requirement.

4. Twenty percent (10%) of the Contract value shall be paid upon arrival at Karachi port and upon issuance of Inspection Certificate by the Engineer after inspection of imported Plant at Karachi port upto his satisfaction.

5. Ten percent (10%) of the Contract value shall be paid on its delivery & verification by the Engineer at Site and upon issuance of Good Receipt Note (GRN) by the Employer.

6. Fifteen percent (15%) of the Contract value shall be paid on completion of installation up to the satisfaction of the Engineer and submission of invoice for the same amount duly certified by the Engineer.

7. Fifteen percent (15%) of the Contract value shall be paid on completion of Testing and Commissioning of all Works up to the satisfaction of the Engineer and after issuance of Taking Over Certificate and submission of invoice for the same amount duly certified by the Engineer.

B) <u>Payment against Supply, Installation, Testing and Commissioning of locally manufactured and imported Plant and Materials procured from local market:</u>

1. Ten percent (10%) recoverable advance shall be paid against the submission of acceptable bank guarantee. The bank Guarantee shall be released after recovery of advance from IPC's.

2. Sixty (60%) of the Contract Value of Local Plant and Imported Plant procured from local market shall be paid on pro-rata basis upon delivery at Site, submission of invoice and after issuance of Inspection Certificate by the Engineer or Engineer's Representative following inspection of such Plant up

to his satisfaction.

3. Twenty percent (20%) of the Contract value shall be paid on completion of installation upto the satisfaction of the Engineer and submission of invoice duly certified by the Engineer.

4. Twenty percent (20%) of the Contract value shall be paid on completion of testing and commissioning of all Works upto the satisfaction of the Engineer and after issuance of Taking Over Certificate and submission of invoice duly certified by the Engineer.

Note: The payment of Third Party Validation in Pakistan shall be done once the report is submitted to Engineer.

All above payments shall be made after deduction of applicable taxes, Advance repayments and Retention Money under the provisions of the Contract.

14.5 Plant and Materials intended for the works

This Sub-Clause shall not apply.

14.6 Issue of IPC

14.6.1 The IPC

In the first line of the 1st paragraph the words "28 days" are substituted by "14 days".

14.7 Payment

The words "or through crossed cheque in favour of the Contractor or JV partners. The Payment to JV partners shall be made at the request of the Joint Ventures in the ratio of their shares specified by them" are added at the end of the Sub-Clause.

14.8 Delayed Payment

In the first paragraph, third line, the words "compounded monthly" are deleted.

The text of 2nd paragraph is deleted and substituted with the following:

"The Employer shall pay to the Contractor compensation at the rate stated in the Contract Data."

15.2 Termination for Contractor's Default

Notice

Following text is added at the end of sub-paragraph (h) of this Sub-Clause:

"For the purposes of this Contract, corrupt and fraudulent practices have been defined in Public Procurement Rules 2004."

15.2.3 After Termination

The word “and” at the end of sub-paragraph (ii) of paragraph (b) is deleted the following paragraph is added after sub-paragraph (iii):

“(iv) all Employer-Supplied Materials and/or Employer's Equipment made available to the Contractor in accordance with Sub-Clause 2.6 *[Employer-Supplied Materials and Employer's Equipment],* and”

15.4 Payment after Termination

The following text is added at the end of this Sub-Clause:

“The Employer shall be entitled to sell any of the Contractor’s Equipment, Temporary Works and unused materials and apply the proceeds of sale towards payment of any debt due from the Contractor to the Employer under this Clause including any outstanding payments to the Subcontractors.

16.2 Termination by Contractor

16.2.1 Notice

The sub-paragraph (j) is deleted in its entirety.

At the end of sub-paragraph (i) “; or” is replaced with “.” and atthe end of sub-paragraph (h) “;” is replaced with “; or”.

In sub-paragraph (f) “84 days” are replaced with “180 days” and text “for reasons not attributable to the Contractor” is added at the end.

16.3 Contractor’s Obligations After Termination

Sub-paragraph (c) is deleted and replaced with:

"(c) deliver to the Engineer all Employer-Supplied Materials and/or Employer's Equipment made available to the Contractor in accordance with Sub-Clause 2.6 *[Employer- Supplied Materials and Employer's Equipment];* and

(d) remove all other Goods from the Site, except as necessary for safety, and leave the Site."

17.1 Responsibility for Care of the Works

After the two instances of “Goods” in the last paragraph, the words “Employer-Supplied Materials and/or Employer's Equipment” are added.

The following Sub-Clause 17.7 is added after Sub-Clause 17.6:

17.7 Use of Employer's Accommodation/ Facilities

The Contractor shall take full responsibility for the care of the items of the Employer's facilities and/or accommodation, if any, as detailed in the Specification, from the date of use and/or occupation by the Contractor until the date on which such use and/or occupation is re-vested in the Employer.

If any loss or damage happens to any of the above items during a time while the Contractor is responsible for its care, arising from any cause other than a cause for which the Employer is responsible or liable, the Contractor shall promptly rectify the loss or damage at the Contractor's risk and cost.

18.1 Exceptional Events

The words "or disorder" are replaced with "disorder or sabotage" in sub-paragraph (c) of the Clause.

18.4 Consequences of anException al Event

The following is added at the end of sub-paragraph (b) after deleting the ".":

", including the costs of rectifying or replacing the Works and/or Goods damaged or destroyed by Exceptional Events, to the extent they are not indemnified through the insurance policy referred to in Sub-Clause 19.2 [*Insurance to be provided by the Contractor*]."

18.5 Optional Termination

In sub-paragraph (c), the words "and necessarily" are added afterthe words "was reasonably".

19.1 General Requirements

Following text is added at the end of first paragraph:

"The Contractor shall immediately after the date of the Letter of Acceptance submit the draft of insurance policies for the Employer's consent."

Following text is added at the end of third paragraph:

"The Contractor shall, within the respective periods stated in the Contract Data submit to the Engineer and the Employer a) evidence that the insurances described in this Clause have been effected, and b) copies of policies of the insurances described in Sub-Clauses 19.2.1, 19.2.4 and 19.2.5."

19.2 Insurance to be provided by the Contractor

19.2.5 Injury to employees

The words "sickness, disease" are deleted in the third line of first paragraph.

The following Sub-Clause is added after Sub-Clause 19.2.6:

19.2.7 Insurance Company

"The Contractor shall be obliged to place all insurances described in this Clause with insurers listed in the Contract Data and rated by PACRA/VIS of rating as provided in Table below:

Accepted Contract Amount (In Eq. million PKR)	Minimum Rating of Insurance Companies
Up to 1000	A(+)
1001 to no limit	AA

21.6 Arbitration

The word "international" is deleted in the sixth line of first paragraph. The text of sub-paragraph (a) is substituted with the following:

"the Dispute shall be finally settled under the Rules of Arbitration, specified in the Contract Data;"

The following Clauses are added after Clause 21

22 Custom Duty

The Employer shall assist the Contractor in obtaining clearance through the customs of the Goods. The customs, import duties and other fees/levies in respect of importation of Goods required for the Works shall be paid by the Contractor.

23 Taxes

The Contractor, Subcontractors and their employees shall be liable to pay income tax, withholding tax, super tax, sales tax and other taxes on income arising out of the Contract. The rates and prices as stated in the contract shall be deemed to cover all such taxes.

24 Integrity Part

If it is found and established at any stage that the Contractor or any of his Subcontractors, agents or servants have violated or involved in violation of the Integrity Pact signed by the Contractor then the Employer shall be entitled to :

(a) recover from the Contractor an amount equivalent to ten times the sum of any commission, gratification, bribe, finder's fee or kickback given by the Contractor or any of his Subcontractors, agent or servants;

(b) terminate the Contract; and

(c) recover from the Contractor any loss or damage to the Employer as a result of such termination or of any other corrupt business practices of the Contractor or any of his Subcontractors, agent or

servants.

The termination under sub-paragraph (b) of this Sub-Clause shall proceed in the manner prescribed under Sub-Clause 15.1 to 15.4 and the payment under Sub-Clause 15.4 shall be made after having deducted the amounts due to the Employer under sub- paragraph (a) and (c) of this Sub-Clause.

25 Facilities to be provided at Site

The Contractor shall provide the following facilities to the Engineer, immediately after the Notice to Commence. The cost of these facilities shall be deemed to have been included in the Contract Price.

a) One (01) car 1300 CC for the site staff and RE during execution of works including running and maintenance charges.
b) Two 1-1/2 ton split A.C installed in the office.
c) Three (03) office tables (5' x 3' size) as selected by the Engineer.
d) Three (03) revolving executive chair.
e) Ten (10) no. of visitor chairs.
f) Two (02) side table.
g) One (01) Laptop (Core i7) with Wifi Internet connection.
h) One (01) Laser printer/Copier/Fax.
i) One (01) Drawing rack.
j) One (01) Filing rack.

All the above facilities shall be property of the Contractor during and after completion of Works under this Contract.

SPECIFICATIONS
Refer Volume II

DRAWINGS
Refer Volume III

HOME DEPARTMENT
GOVERNMENT OF SINDH

ESTABLISHMENT OF FORENSIC SCIENCE LABORATORY IN SINDH AT KARACHI

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF REMAINING WORKS - CARGO ELEVATOR, DIESEL GENERATOR & ALLIED WORKS, HVAC DUCTING, FM200 AND ELV SYSTEM

BIDDING & CONTRACT DOCUMENTS

VOLUME II

Specifications

APRIL 2025

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VOLUME II - SPECIFICATIONS

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SECTION - 0100

1. GENERAL REQUIREMENTS

01 GENERAL

The Conditions of Contract Part I & II shall form an integral part of these General Requirements.

The Contractor shall notify all sub-contractors of the provisions of the Conditions of Contract and the General Requirement of this Specification.

The arrangement and divisions of these Specifications is not to be construed as establishing the limits of responsibility of sub-trades.

The Contractor is responsible for delineating the scope of Sub-Contracts and for coordinating all the Works.

All works shall be carried out in accordance with the following specifications, supplemented by detailed specifications contained in the following sections. Any inconsistencies or ambiguities shall be brought to the notice of the Engineer for his clarification/decision. Decision and direction of the Engineer, in all such cases, shall be final and binding.

The Contractor shall make himself thoroughly familiar with the site conditions, foresee any and all problems likely to be encountered during execution of the works, and shall be able and ready to solve them effectively. Proposals for solutions to the problems shall be submitted to the Engineer for approval before proceeding with the work.

02 APPLICABLE CODES AND STANDARDS

In the absence of other Standards being required by the Contract Documents, all work and materials shall meet the requirement of the Uniform Building Code of the United States, and/or applicable American Society for Testing Materials (ASTM),American Association of State Highway and Transportation Officials (AASHTO) Specifications and the latest American Concrete Institute Manual of Concrete Practice and American Institute of Steel Construction (AISC) Manual relevant to the Works except in cases where the Pakistan Building Code requires a higher standard. In such cases the Pakistani Code shall govern. Where the abbreviations listed below are used, it refers to the latest code, standards, or publication of the following organizations:

AASHTO	American Association of State Highway and Transportation Officials.
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
ASA	American Standard Association
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Material
AWS	American Welding Society
BSI	British Standards Institute
ICAO	International Civil Aviation Organization

BSICP	British Standard Institute Code of Practice
PCA	Portland Cement Association
PSI	Pakistan Standard Institute
PSQCA	Pakistan Standard & Quality Control Authority.
UBC	Uniform Building Code
UPS	Uniform Plumbing Code

If the Contractor, at any time and for any specific reasons, wish to deviate from the above standards or desires to use materials or equipment other than those provided for by the above standards, then he shall state the exact nature of the change giving the reasons for making the change and shall submit complete specifications of the materials and descriptions of the equipment for the Engineer's approval, whose decisions shall be conclusive and binding upon the Contractor.

03 CODES, STANDARDS, CERTIFICATES

The Contractor shall supply and have at his site office:

Copies of all latest editions of codes and standards referred to in these specifications by number, or equivalent codes and standards approved by the Engineer.

Catalogues and published recommendations from manufacturers supplying products and materials for the project.

The Contractor shall provide manufacturer's or supplier's certificates to the Engineer for all products and materials which must meet the requirements of a specific code or standard as stated in these Specifications.

04 UNITS OF MEASUREMENTS

The FPS or SI System of Units shall be used throughout this Project.

05 MANUFACTURER'S RECOMMENDATIONS

Installation of manufactured items shall be in accordance with procedures recommended by the manufacturer or as approved by the Engineer.

06 EXISTING CONDITION AT SITE

Drawings and information pertaining to existing project conditions are available at Engineer’s office for reference.

Neither the Employer nor the Engineer warrants the adequacy or correctness of these.

07 PROTECTION AND PRECAUTIONS

The Contractor and his sub-contractors shall afford all necessary protection to existing structures and will be required to make good at his own expense any damage done to such structures through his own or his representatives or subcontractors' fault and negligence.

The Contractor and his sub-contractors shall afford all necessary protection to existing roads in the area. He will clear and make good at his own expense any damage to or debris on these roads through his own fault and negligence. He must at all time ensure the free and normal flow of traffic and shall not cause obstruction to the traffic system. The Contractor and his sub-contractors shall provide and maintain necessary protection and precautionary measures such as warning signs, warning lamps and barricades etc. to prevent accidents.

The Contractor shall promptly correct all such damage to original condition at no additional expense to the Employer.

The Contractor shall cooperate with other Contractors performing work under other Contracts as necessary for completion.

08 SETTING OUT OF WORK

8.1 Verify accuracy of layout information shown on the Drawings, in relation to the property survey and existing benchmarks before proceeding to layout the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

(a) Do not change or relocate benchmarks or control points without prior written approval from the Engineer. Promptly report lost or destroyed reference points or requirements to relocate reference points because of necessary changes in grade, location or conflicting construction.

(b) Promptly replace lost or damaged project control points with prior approval of the Engineer. Replacement of project control points shall be based on original survey control points.

(c) Establish and maintain the required number of permanent benchmarks on the job site as directed by the Engineer. Benchmarks shall be located from and referenced to data established from survey control points. Record benchmark location, with horizontal and vertical data, on Project Record Documents.

8.2 Existing utilities and equipment:

(a) The existence and location of underground and other utilities and construction indicated in the Construction Documents as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction and record this information on the relevant plan.

(b) Prior to construction, verify the location and invert elevation at points of connection to sanitary sewer, storm drainage and water service piping. Verify the location of electrical power and communication utilities for interface.

8.3 PERFORMANCE

(a) Working from lines and levels established by the property survey, establish benchmarks and reference markers to set lines and levels at each story of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Drawings shall not be scaled to determine dimensions.

(b) Maintain a Surveyor's Log of control and other survey work. Surveyor's Log shall be made available for The Engineer reference.

Record deviations from required lines and levels, and advise the Engineer when deviations that exceed indicated or recognized tolerances are detected. Contractor shall record on Project Record Drawings deviations that are accepted and not corrected.

8.4 Site Works:

(a) Locate and lay out works, fill and topsoil placement, slopes and invert elevations by instrumentation and similar appropriate means.

(b) Prior to Substantial Completion, prepare a final property survey showing significant features (real property) for the Project. Include on the survey a certification, signed by the Surveyor, to the effect that principal metes, bounds, lines and levels of Project are accurately positioned as shown on survey.

09 SEQUENCE OF CONSTRUCTION

The Contractor shall submit his proposal for approval of the Engineer the sequence of Construction, prior to starting the works. The works shall be executed as per approved sequence of construction.

10 PARTIAL POSSESSION

Whenever, as determined by the Employer any portion of work performed by the Contractor is in a condition suitable for use, the Employer may take possession of or use such portion.

Such use by the Employer shall in no instance be construed as constituting final acceptance, and shall neither relieve the Contractor of any of his responsibilities under the Contract, nor acts a waiver by the Employer of any of the conditions thereof, provided that the Contractor shall not be liable for the cost of repairs, re-work, or renewals which may be required due to ordinary wear and tear resulting from such use. However, if such use increases the cost or delays to the completion of remaining portions of work, the Contractor will be entitled to an equitable adjustment.

If, as a result of the Contractor's failure to comply with the provision of the Contract, such use proves to be unsatisfactory, the Employer will have the right to continue such use until such portion of the work can, without injury to the Employer, be taken out of service for correction of defects, errors, omissions, or replacement of unsatisfactory materials or equipment, as necessary for such

work to comply with the Contract; provided that the period of such operation or use pending completion of appropriate remedial action shall not exceed twelve months unless otherwise mutually agreed upon in writing between the parties.

11 EXISTING SERVICES

The Contractor shall search for, find, locate and protect any wiring, cable, duct, pipe work, etc., within or immediately adjoining the site area.

The Contractor shall take full responsibly for safety of existing service lines, utilities and utility structures uncovered or encountered during excavation and construction operations.

The Contractor shall take full responsibility for damaging any such service lines, utility/utility structure and any cost and/or expense that arises or issues from any such damage shall be borne directly by him. If damage to any such service occur the Contractor shall forthwith take remedial action, initiate safety precautions, install temporary services and carryout repair all at his own cost and expense and inform the Engineer and notify all relevant authorities.

Existing utilities which are to remain in service for or after the works are to be determined by the Contractor. If any existing service lines, utilities and utility structures which are to remain in service are uncovered or encountered during these operations, they shall be safeguarded, protected from damage, and supported.

12 PLANT AND EQUIPMENT

The Contractor shall submit a detailed list of plant and equipment which he shall undertake to bring to the site to carry out the work. The list shall satisfy the Engineer as to type, size and quantity. The list shall include for each piece of equipment the type, manufacturer, model, identification number and year of manufacture. The Contractor shall provide on the site of the work at his cost all of the equipment listed and all subsequent equipment required for approval of the detailed programme of work and such equipment which may be directed by the Engineer. The Contractor shall supply all plant and equipment necessary for the construction of each phase of the work and it must be on site, inspected and approved by the Engineer.

13 CONSTRUCTION AREA AND ACCESS

The Contractor shall confine his operations to the areas that are actually required for the Works and shall fence the area accordingly. Arrangements for access roads, storage areas and routes for haulage of materials are to be made by the Contractor at his own cost, subject to the approval of the Engineer.

14 STORAGE & HANDLING FACILITIES

The Employer will provide the Contractor possible space within or nearby the area of site of works for the storage of plant, equipment and materials and for Contractor's temporary office, during the currency of the Contract. In case the adjacent area as required by the Contractor is not available within the Project

boundary for storage of plant, equipment and machines then the Contractor shall arrange at his own expense possible space for storage of plant, equipment and machines at his own cost and expense. On no account shall such temporary installations conflict/interfere with any of the permanent installations, services and any operational function of Employer. The handling and storage of all plants, equipment and materials at site shall be the sole responsibility of the Contractor and at no risk and cost to the Employer.

The Contractor shall protect all material against corrosion, mechanical damage or deterioration during storage and erection on site. The protection methods shall be to the approval of the Engineer.

15 TEST LABORATORY AND TESTING

15.1 Testing, except as otherwise specified herein, shall be performed by an approved testing agency as proposed by the Contractor and at no extra cost to the Employer. The Engineer may require all testing to be carried out under his supervision only.

15.2 If suitable and adequate material testing laboratory is not available in the vicinity, then the Contractor shall provide and maintain a materials testing laboratory in the vicinity of the Contractor's Camp and the laboratory shall have sufficient working area and shall be equipped with all necessary facilities including a suitable store room.

15.3 The Contractor shall supply and maintain to the satisfaction of the Engineer or his representative complete testing equipment, apparatus, tools, gauges, instruments, etc. in sufficient number and adequate for all tests to be carried out as specified in these specifications. Valid calibration certificates of gauges / instruments / equipment shall be provided by the Contractor.

15.4 The Contractor, after the approval by the Engineer for the source of cement and steel shall make available at the site sufficient stock of the materials in advance in order to allow sample testing for quality control prior to use.

15.5 The quality control testing shall be performed by the Contractor's competent personnel in accordance with a site testing and quality control programme to be established by the Contractor and approved by the Engineer or his Representative. The Contractor shall keep a complete record of all quality tests performed on site and submit the same to the Engineer. All quality control and related tests shall be carried out in accordance with applicable standards and codes.

16 CONSTRUCTION & CHECKING AT SITE

The Contractor shall submit to the Engineer in due time for approval and discussion, his proposals and plans as to the method and procedure to be adopted for the temporary and permanent works involved.

The submitting to these suggestions and arrangements, and the approval thereof by the Engineer shall not relieve the Contractor of his responsibilities and duties under the Contract.

The carrying out of all work included in the Contract is to be supervised by a sufficient number of qualified representatives of the Contractor and full facilities and assistance are to be afforded by the Contractor for the Engineer or his Representative to check & examine the execution of the work.

The Engineer reserves the right to inspect all parts of the works but may at his discretion waive inspection on certain items. This shall in no way absolve the Contractor from his responsibilities. This particularly applies to the checking of materials, the accurate setting out of foundations, and to the levelling, setting and aligning of the various parts, and to the proper fitting and adjustment of manufactured and finished materials and fixtures in position.

If the Engineer or his Representative find that the work progress is slow in such a way that the works or parts thereof will not be completed in the time specified, then he shall order the Contractor to work overtime or in shifts and the Contractor shall comply. These arrangements will be free of all financial encumbrances and at no additional costs to the Employer.

In the event of night work, the Contractor shall provide sufficient and adequate lighting to the satisfaction of the Engineer or his Representative and shall supply the necessary manpower for satisfactory continuation of the work after normal hours.

17 BAR BENDING SCHEDULE

Bar bending (reinforcement bars) schedule of all drawings shall be prepared by the Contractor and submitted in triplicate to the Engineer for approval.

18 DRAWINGS

18.1 Bidding Drawings: The drawings listed in the General Conditions of Contract, Volume I and provided in Volume III are referred to as Bidding Drawings and these show the scope of work to be performed by the Contractor. Bidding Drawings shall not be used as a basis for fabrication or construction but may be used as a basis for placing preliminary order for materials, subject to corrections based on the future issue of Drawings as provided under sub-clause 18.2 Drawings Issued for Construction. Bidding Drawings are subject to be modified and supplemented by additional detail by the Engineer.

18.2 Drawings Issued for Construction: After Award of Contract, Bidding Drawings shall be replaced by Drawings Issued for Construction including supplementary Specifications as may be necessary. Such drawings and specifications shall be construed to be included in the expression Custody and Supply of Drawings under Sub-Clause 6.1 of Conditions of Contract Part I. Drawings Issued for Construction may include some of the Bidding Drawings with or without modification and additional drawings as required to express design intent in greater detail. Such drawings may also be modified from time to time. Drawings Issued for Construction will be the drawings from which shop, fabrication, erection, installation, concrete placing, formwork, or other construction detail drawings shall be prepared by the Contractor. The work shall be executed in conformity with Drawings Issued for Construction. The Contractor shall prepare a schedule of Drawings Issued for Construction of various parts of the Works based on

Construction programme approved by the Engineer for issuance to the Contractor from time to time.

18.3 Study of Drawings: The Contractor shall study all Drawings Issued for Construction carefully as soon as practicable after receipt thereof, and any errors discovered shall promptly be brought to the knowledge of the Engineer for his instructions.

18.4 Copies of Drawing: Drawings will be issued to the Contractor free of charge as follows:

Drawings Issued for Construction - Two copies as specified in sub-clause 6.1 of Conditions of Contract Part - I i.e. Custody and Supply of Drawings.

18.5 Drawings to be furnished by the Contractor:

(a) Shop Drawings.

All shop drawings required for the work including all kinds of fabrication, field erection, installation, placement and layout drawings shall be furnished by the Contractor for approval of the Engineer. If additional detail drawings are necessary to complete any part of the work, such as additional reinforcing steel, drawings shall be prepared by the Contractor and submitted to the Engineer for approval. All drawings shall be complete and shall be submitted in due time and in logical order to facilitate proper coordination.

(b) Lift and placement Drawings.

At least thirty calendar days prior to starting construction of any concrete lift or other placement, the Contractor shall submit lift or other placement drawings to the Engineer for approval. Lift or other placement drawings shall be submitted for each lift or other placement of concrete to be placed. These drawings shall be to such scale as to clearly show all recesses, openings, and embedded parts, including embedded structural steel, mechanical and electrical items, reinforcement placement in each lift in sufficient detail for proper execution of the work.

(c) Construction Plant Layout Drawings.

Three prints of drawings, showing the layout of construction plant and equipment the Contractor proposes to use on the work, shall be submitted by the Contractor for review to the Engineer. The drawings shall show the locations of the principal components of the construction plant, offices; storage areas and yards which the Contractor proposes to construct or use at the site of the work and elsewhere. The drawings shall also show the unloading facilities for materials and equipment at the work site.

18.6 Submissions and Approvals:

(a) Except as otherwise specified, three copies of each drawing for approval or review shall be furnished to the Engineer. Within thirty calendar days after receipt, the Engineer will send one copy to the Contractor marked Approved, Approved/Except as Noted, or Returned for Correction. The notations Approved and Approved/Except as Noted will authorize the Contractor to proceed with the fabrication of the materials and equipment covered by such drawings subject to the corrections, if any, indicated thereon. Drawings returned for correction will be resubmitted for approval in the same manner as for new drawings. Every revision made during the life of the Contract shall be shown by number, date and subject in a revision block.

(b) Upon receipt of prints which have been Approved or Approved Except as Noted, the Contractor shall furnish three prints plus one reproducible of each drawing to the Engineer. If revisions are made after a drawing has been approved, the Contractor shall furnish 3 additional prints and one reproducible subsequent to each approved revision.

(c) Shop drawings to be prepared by a Sub-contractor shall be submitted in the same manner as (a) & (b) above but they will be submitted through the Contractor.

(d) All of the applicable requirements of this Clause with reference to drawings to be prepared by the Contractor, including Sub-contractors, shall apply equally to catalogue cuts, illustrations, printed specifications, or other data submitted for approval.

(e) Any work done on Contractor's drawings shall be at the Contractor's risk. The Engineer will have the right to request any additional details and to require the Contractor to make any changes in the drawings which are necessary to conform to the provisions and intent of design and specifications without additional cost to the Employer. The approval of the drawings by the Engineer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory. Approval by the Engineer of the Contractor’s drawings shall not be held to relieve the Contractor of his obligation to meet all the requirements of the Specifications or of his responsibility for the correctness of the Contractor's drawings or of his responsibility for correct fit of assembled parts in final position or of his responsibility for the adequacy of method of construction.

19 AS-BUILT DRAWINGS

The Contractor shall, at all times, keep on the site one copy of all drawings and approved samples together with copies of all building, mechanical, electrical and public safety codes and relevant standards applicable to the works. All such material shall be made available to the Engineer.

In addition, the Contractor shall, at all times, keep on site a separate set of prints on which shall be noted neatly, accurately and promptly as the work progresses

all significant changes between the work shown on the drawings and that which is actually constructed. The sub-Contractors shall each keep on site, at all times, a separate set of prints of the drawings showing their parts of the work on which shall be noted, neatly accurately and promptly as work progresses the exact physical location and configuration of the works as actually installed, including any revisions or deviation from the Contract Documents.

At the completion of the works, the Contractor shall at his expense, supply to the Engineer six copies and one reproducible copy of all drawings alongwith CD containing all as built drawings amended to comply with the work "As Built". The Contractor shall provide in the same format as the original drawings, any additional drawing required to record the work.

20 RESTORATION AND CLEANING

The Contractor shall do regular cleaning and clean away all rubbish and excess materials that may accumulate from time to time on completion and before handing over. Upon completion of the works he shall obliterate all signs of temporary construction facilities such as work areas, structures, foundations of temporary structures, stock piles of excess or waste materials, or any other vestiges of construction, unless otherwise directed by the Engineer. The works and site shall be left in a clean and satisfactory state for immediate use and occupation. Care shall be taken not to use any cleaning materials which may cause damage to the surface to be cleaned.

21 PROTECTION OF THE WORKS

The Contractor shall whenever necessary cover up and protect the works from weather and damage by his own or other workmen performing subsequent operation. He shall provide all necessary dust sheets, barriers and guard rails and clear away the same at completion.

The Contractor shall take all proper steps for protection at all places on or about the works which may be dangerous to his workmen or any other person or to traffic. The Contractor shall provide and maintain warning signs, warning lamps and barricades as necessary.

22 PRODUCT DATA

Manufacture’s standard schematic drawings shall be modified or deleted to indicate only information which is applicable to the project. Such standard information shall be supplemented to provide all additional applicable information.

Manufacturer's catalogue sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive literature shall be clearly marked to identify pertinent materials products or models. Dimensions and required clearances shall be indicated. Shop performance characteristics and capacities shall be noted.

23 SAMPLES

23.1 The Contractor shall furnish for approval of the Engineer with reasonable promptness all samples as directed by the Engineer or specifically called for in these Specifications. The Engineer shall check and approve such

samples with reasonable promptness for compliance with the requirements of Contract Documents. All work shall be in accordance with approved samples.

23.2 Duplicate final approved samples, in addition to any required for the Contractor's use, shall be furnished to the Engineer, one for office use and the other for the Site.

23.3 Samples shall be furnished so as not to delay fabrication, allowing the Engineer reasonable time for consideration of the sample submitted.

23.4 Each sample shall be properly labeled with the name and quality of the material, manufacturer's name, name of the project, the Contractor's name and the date of submission, and the Specifications Article number to which the sample refers.

23.5 The manufacturer's installation directions shall be provided with each sample. The Contractor shall pay all transportation costs and deliver samples to the Engineer's office, Site or testing laboratory as directed by the Engineer.

Samples will not be returned unless return is requested at the time of submission; all packing and transportation costs for the return of samples shall be paid by the Contractor.

23.6 Samples shall be of adequate size and number to permit proper evaluation of the material by the Engineer. Where variations in colour, texture, dimensions or other characteristics are to be expected, the Contractor shall submit samples showing the maximum range of variation. Materials exceeding the range of variation of the approved samples shall not be used on the Work.

23.7 If both Shop Drawings and samples are required for the same item, the Engineer may require both to be submitted before approving either.

23.8 No acceptance or approval of any Shop Drawings or sample, or any indication or directions by the Engineer on any Shop Drawings shall constitute an authorization for any increase in the Contract Sum.

24 PRODUCT QUALITY AND HANDLING

Suppliers of local and foreign products and installations specified shall have been regularly engaged in the business of manufacturing, fabricating, installing and / or servicing work required for a period not less than 5 years. In addition, the Engineer may request as appropriate a:

- list of similar installations that describes project, scope and date of completion.
- complete literature, performance data, and technical data.
- list of services record within Pakistan.
- location of service office from which this installation could be maintained.

For the actual fabrication, installation, and testing of the specified work, use only thoroughly trained and experienced workmen completely familiar with the items required and with the manufacturers recommended methods of installation. In acceptance or rejection, no allowance will be made for the lack of skill on the part of workmen.

Use all means necessary to protect materials before, during and after installation and to protect the installed work and materials of all other trades. In the event of damage, immediately make all repairs and replacement necessary for approval and at no additional cost to the Employer.

25 INSPECTION & TESTS REPORTS

All equipment and materials furnished under these specifications and all work performed in connection therewith will be subject to rigid inspection by the Engineer or the Engineer's Representative. Acceptance of equipment and material or the waiving off inspection thereof shall in no way relieve the Contractor of his responsibility for meeting the requirements of the Contract.

The Contractor shall furnish the Engineer with certified true copies of test reports of all materials used in the manufacture and fabrication of equipment and material. The result of these tests shall be in such form as to show compliance with the applicable Specifications, standards and codes for the material used.

26 ACCIDENT PREVENTION, PROTECTIVE EQUIPMENT

The Contractor shall in respect of safety, health and welfare matters abide by the applicable laws, legislation and regulations of the Pakistan and (to the extent the same are applicable therein) the laws and regulations of the Pakistan, Statutory Regulations published and best industry practice for the safety, health and welfare of any employee of the Contractor, the Employer or the Engineer.

The Contractor shall maintain such records and make such reports concerning safety, health and welfare of persons and damage to property as the Engineer or the Employer may from to time require.

The Contractor shall report to the Employer and the Engineer details of any accident as soon as possible after its occurrence. The Contractor shall in addition report all accidents to the appropriate authorities to the extent required by law. In the case of any fatality or serious accident, the Contractor shall, in addition, notify the Employer and the Engineer immediately by the quickest available means.

Safety Plan

The Contractor shall submit for approval by the Engineer a project specific safety plan within fourteen (14) days of having received the Notice to Commence.

Medical Facilities

Contractor shall at his expense:

- Arrange for medical attention to be available when necessary,
- Provide dressing stations complete with all adequate first-aid equipment on

the site,

- Display in suitable places the names of his employees who are available from time to time to render first aid services,
- Provide for the transport of serious cases to the nearest hospital,

H.S.E Representative

The Contractor shall depute qualified HSE representative at Site with suitable number of supervisors to ensure 100% compliance of HSE requirements as specified in HSE Plan.

The representatives must be fully authorized and equipped to correct unsafe or excessively inconvenient conditions at short notice.

27 TEMPORARY FACILITIES

The Contractor shall provide, erect or install, maintain, alter as necessary and remove on completion except as otherwise directed by the Engineer all temporary facilities and services including access roads as described hereinafter and/or in the Contract Document.

The Contractor's temporary site office shall be available for use not later than one month after the date of the site handing over.

Installation of temporary services at the site shall be given priority over all other construction at the site.

27.1 Temporary Road

The Contractor shall prepare and maintain such temporary roads as may be necessary, from the site to the nearest road and also within the site. Such roads shall be positioned strictly in accordance with the Engineer's instructions and the Contractor shall reduce or control any dust nuisance by spraying with water as directed. The Contractor shall satisfy himself as to the locations and nature of the proposed access routes to the site and shall be responsible for preventing any damage whatsoever to adjacent property and vegetation and keeping the access road free from debris at all times.

27.2 Temporary Services

(a) Temporary Water Supply

The Contractor shall supply in sufficient quantity all necessary potable and other water for construction purposes for all trades at point within a reasonable distance of the work. He shall make arrangements and pay charges for water service installation, maintenance and removal thereof, and pay the costs of water for all trades.

When the permanent water supply and distribution system has been installed, it may be used as the source of water for construction purposes provided that the Contractor obtains the written approval of the Engineer and the Employer and assumes full responsibility for the entire water distribution system and pays all charges/costs for operation and

maintenance of the system mutually agreed between the Employer and the Contractor.

Temporary pipe lines and connections from the permanent service line, whether outside or within the area of site of works but necessary for the use of Contractor and his sub-contractor shall be installed, protected and maintained at the expense of the Contractor.

At completion of the work or at such time as the Contractor makes use of the permanent water supply installation, the temporary water services equipment and piping shall be removed by the Contractor at his own expense.

(b) Temporary Electricity

The Contractor shall make all the necessary arrangements for a temporary electricity service, pay all expense in connection with the installation, operation and removal thereof and pay the costs of electricity consumed by all trades.

In the event that the site can not be connected to a local electricity network or where the available power is insufficient the Contractor has to make his own provision and maintain such installation.

A temporary lighting system shall be furnished, installed and maintained by the Contractor as required to satisfy the minimum requirements for safety and security. The temporary lighting system shall afford adequate general illumination to all building areas. Adequate outdoor lighting shall be provided to illuminate staging trenches and the like to the satisfaction of the Engineer and general illumination throughout adequate for watchmen and emergency personnel.

Temporary equipment and wiring for power and lighting shall be in accordance with the applicable provisions of governing codes. Temporary wiring shall be maintained in a safe manner and utilised so as not to constitute a hazard to persons or property.

When the permanent electrical power and lighting systems are in an operating condition, they may be used for temporary power and lighting for construction purposes provided that the Contractor obtains the written approval of the Engineer and the Employer and assumes full responsibility for the entire power and lighting system and pays all charges/costs for operation and maintenance of the system mutually agreed between the Employer and the Contractor.

Approval, license etc. if required under local laws will be obtained by the Contractor on his own responsibility and cost.

At completion of construction work, or at such time as the Contractor makes use of permanent electrical equipment and devices, temporary electricity services shall be removed by the Contractor as his own expense.

(c) Waste Disposal

The Contractor shall make such temporary provisions as may be required in order to dispose of any chemicals, fuels, grease, bituminous materials, waste and soil waste and the like without causing pollution to either the site or the environment. Disposal of any materials, wastes, effluents, garbage, oil, grease, chemicals and the like shall be in areas specified by the concerned local authority proposed by the Contractor and subject to the approval of the Engineer. If any waste material is dumped in unauthorized areas the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed area. If necessary, contaminated ground shall be excavated, disposed off as directed by the Engineer and replaced with suitable fill material compacted and finished with topsoil all at the expense of the Contractor.

(d) Fire Protection

The Contractor shall provide and maintain adequate fire protection in the form of barrels of water with buckets, fire bucket tanks, fire extinguishers, or other effective means ready for instant use, distributed around the project and in and about temporary inflammable structures during construction of the works.

Gasoline and other flammable liquids shall be stored in and dispensed from safety containers approved by the Engineer and storage shall not be within building.

Torch-cutting and welding operations performed by the Contractor shall have the approval of the Engineer before such work is started and a chemical extinguisher is to be available at the location where such work is in progress.

The Contractor shall follow the instructions and specifications of the Civil Defence Department and or other local authority.

28 CONSTRUCTION SCHEDULE

A Construction schedule shall be maintained in accordance with the provisions of the General Conditions of Contract.

The schedule shall be accompanied with sufficient data and information including all necessary particulars of constructional plant, equipment, machinery, temporary Works, arrival of plant, equipment at site and their installation, method of operation, work forces employed, etc., for activities of the Works.

Should the Engineer consider any alteration or addition in the programme and time schedule, the Contractor shall conform thereto without any cost to the Employer.

Whenever necessary and wherever the progress of the actual work shows departure, the programme and time schedule shall be undated and submitted to the Engineer for his approval.

29 NOTIFICATION TO THE ENGINEER

The Engineer's Representative shall be notified daily in writing of the nature and location of the Works the Contractor intends to perform the next day so as to enable necessary inspection and measurement to be carried out. The Engineer may, if necessary, direct that longer notice be given of certain operations.

30 NIGHT WORK

When work is done at night the Contractor shall maintain from sunset to sunrise such lights on or about his work and plant as the Engineer may deem necessary for the proper observations of the work and the efficient prosecution hereof.

31 WEATHER

No work is to be undertaken when, in the opinion of the Engineer, the weather is so unsuitable that proper protection of the work cannot be ensured.

32 CO-ORDINATION WITH OTHER CONTRACTORS

The Contractor shall make all necessary coordination with other Contractor and shall make sure that all embedding components such as pipes, steel bases etc. (as required for completion of electrical and other works) are properly, accurately and timely installed.

The Contractor shall inform other contractors if any, the schedule of any construction activity well in advance giving him sufficient time to finish his part of job, before any compaction/concreting etc. The Contractor shall get the signature of the authorized representative of the other contractor, before carrying out any construction activity.
If any part of existing work is damaged or has to be dismantled or redone due to negligence/omissions/incorrect position of the embedding etc. on part of the Contractor, all such losses/expenses shall be borne by the Contractor.

All expenses incurred for the above works including coordination are deemed to be covered in his Bid cost and no separate/extra payment shall be paid against such item.

33 SUBMISSION REQUIREMENTS

33.1 Schedule submission at least sixty days before the dates when reviewed submittals will be needed.

33.2 Submit Shop Drawings as per provision given in Sub-Clause 18.5 (a) of this General Requirements and number of copies of Product Data which the Contractor requires for distribution plus four copies which will be retained by the Engineer.

33.3 Submit three samples unless otherwise specified.

33.4 Accompany submittals with transmittal letter, in duplicate, containing:

- Date
- Project title and number
- Contractor's name and address
- The number of each Shop Drawing, Product Data and the Sample submitted.
- Notification of deviations from Contract Documents.
- Other pertinent data.

34 RESUBMISSION REQUIREMENTS

Shop Drawings:

- Revise initial drawings as required and resubmit as specified for initial submittal.
- Indicate on drawings any changes which have been made by the Engineer.
- Product Data and Samples: Submit new data and samples as required for initial submittal.

35 SURVEY INSTRUMENTS

All the instruments, equipment, stakes and other material necessary to perform all work shall be provided by the Contractor. The survey work shall be carried out by competent staff consistent with the current practices. The Contractor shall maintain on site surveying instruments in perfect working conditions to enable the Engineer to check lines and level at all times.

Survey instruments and equipment shall include but not limit to the following:

- Electronic Total Station
- Electronic Data Recorder
- Disto Laser Meter
- Precision Level Invert Staff
- Automatic Levels
- Power level
- Compass, steel tape, ranging poles

36 MONTHLY PROGRESS REPORT AND PHOTOGRAPHS

36.1 During the continuance of the Contract, the Contractor shall submit monthly progress reports on forms as approved by the Engineer. Such monthly reports shall show the actual progress completed as of date of the report plotted against the schedule as given by the Contractor at the start of work and shall be broken down so as to indicate status of all activities associated with mobilization, design, material procurement, manufacture, surveys works, tests with regard to the agreed Contract programme.

36.2 The Employer and the Engineer reserve the right to coordinate the schedules of this Contractor and other contractors working at the Site, and to adjust and/or change any and all such schedules as required during the course of construction in order to achieve a coordinated project in harmony with the completion date.

36.3 Commencing after the first month of construction, and continuing every month until completion, the Contractor shall take and submit photographs to the Engineer's Representative, to show progress of his work and completion of each structure or major feature.

37 CONTRACTOR TO NOTIFY DELAYS ETC.

Any delay which will affect the completion of Works shall be detailed by the Contractor who shall state the action he is taking for effective completion of the Contract programme.

The Contractor shall submit a report in respect of the various sections of the Works, the equipment in use or held in readiness, a return of labour and supervisory staff, and details of any matters arising which may generally affect the progress of the work.

The Contractor shall give a summary of the detailed progress report giving the position with regard to the agreed Contract programme.

The progress reports shall be set out in a format to the approval of the Engineer, and forwarded promptly so that on receipt the information contained therein is not more than 21 days out of date.

If during execution of the Contract, the Employer considers the progress position of any section of the work to be unsatisfactory, or for any other reason relating to the Contract, he will be at liberty to convene a meeting and the Contractor’s Representatives are to attend such meeting.

The Contractor's Site Office shall prepare and submit 6 copies of a monthly progress report along with the photographs to the Employer and Engineer's Site Office. This report shall summarize site activities and record and details where difficulties in maintaining the agreed programme are being experienced or are likely to cause subsequent delay.

The Contractor's Site Office shall also prepare and submit to the Engineer's Site Office 2 copies of Daily Activity Report summarizing the main activities to be undertaken each day, noting special activities such a tests, alignment checks, etc. The Contractor shall be responsible for submitting daily, manpower & equipment details deployed at site. The contractor shall also be responsible for expediting the delivery of all material and equipment to be provided by himself and his subcontractors if any.

38 PHOTOGRAPHS

As soon as work commences on Site, the Contractor shall provide photographs of the works from positions to be selected by the Engineer. Each photographic /

digital print shall not be less than 100 mm x 100 mm and shall bear a printed description, serial number and date when taken.

The negatives/soft copies of all photographs shall be held at the Contractor's Site Office, numbered and handed over to the Employer at the completion of the Contract.

39. SITE FACILITIES FOR THE EMPLOYER AND THE ENGINEER

39.1 **Site Office**

The Contractor shall construct, provide and maintain 01 Site office for the Employer and the Engineer's Site Team of about 1000 square feet covered area each. The Contractor will submit drawing for the Site Office showing details & requirements for approval of the Engineer within 15 days after receipt of Letter of Award.

The Site Office shall be furnished and equipped with new and unused furniture and equipment as per the list given below:

S. No.	Description of furniture / equipment	Qty for Engineer's Office
01	Office table with drawers and side racks (6x3ft.size)	2
02	Officer's table with drawers and side racks (6x4ft. size)	2
03	Revolving sitting chairs with arms (standard size)	2
04	Sitting chairs (visitor's) with arms (standard size)	8
05	Steel filing cabinet (Standard size)	2
06	Wooden filing cabinet (Standard size)	2
07	Wooden pigeon hole rack for drawing (3x4x2ft.)	2
08	Laptop latest model & internet connection, UPS along with A4-A3 Laser Printer or latest model	2
09	Spilt Type A.C (1-1/2 ton)	2
10	Mobile Phone (android) with usage of maximum Rs. 2000/Month each	3
11	Water Dispenser with maintenance	1
12	Electric Kettle with maintenance	1
13	Office/Tea Boy	1
14	Back-up Generator sets for office	1

However, if any equipment, furniture and installations become unserviceable for any reason whatsoever the Contractor shall promptly replace the same as and when directed by the Engineer. The Site Office shall be connected to the Electrical System, potable water supply system, sewage disposal system and un-interrupted supply of utilities during the Contract period. The Contractor shall arrange professional cook and all time consumables for

making tea, coffee and refreshments for both the Employer's and the Engineer's offices.

All monthly utility bills pertaining to the Site office would be borne by the Contractor. Failure of the contractor to do so shall make him liable to deduct utility bills cost from his due monies under the Contract and would be paid by the Employer directly to the concern department.

The Site Office including fittings, fixtures and furnishing shall be the property of the Contractor on completion of the Contract.

39.2 **Transport Facility**

The Contractor shall provide, operate and maintain following brand new (latest model) vehicles for the Engineer's site supervision teams to meet their transportation needs for the entire duration of actual construction period as well as for the duration of subsequent defects liability period. The vehicles are listed as under;

S. No.	Description of Vehicle with Model (Brand New and Latest Variants)	For the Engineer & his Staff Use
01	1300 CC	1
02	Changan Alswin 1.3L Blue Core	1

The use of such transport facility shall be under the control of the Engineer as above. The Contractor shall be wholly responsible for providing at all times satisfactory operating services for the Engineer. The Contractor shall furnish, supply and provide, as may be necessary without specific direction of the Engineer, all fuels (upto a limit of 300 Liters for each vehicle), lubricants, tires and other supplies, all maintenance, repairs and running costs and suitably qualified drivers at all times.

Prior to ordering the Vehicles, the Contractor shall furnish to the Engineer for approval, detailed specification, name of manufacturer and model no. of the vehicle to be supplied. These data shall be presented within one week from the date of Engineer's Order to proceed with the works and the vehicles shall be furnished to the Engineer upon approval within two weeks from the date of Engineer's Order to supply the Vehicle.

The vehicle shall be right hand drive, and shall be of brand approved by the Engineer, properly serviced and ready for use. The Contractor shall provide vehicle to replace any such motor vehicle that is temporarily or permanently rendered unserviceable for any reason or declared to be beyond repair by the Engineer, at no additional cost to the Employer. Failure of the Contractor to do so shall make him liable its cost/expense up to Rs. 1,000,000/- per month for vehicles payable directly to Employer/Engineer for the entire Contract period or till such time that transport as stipulated above is provided by him.

The vehicles shall be right hand drive, and shall be of brand approved by the Engineer, properly serviced and ready for use. The Contractor shall provide vehicle to replace any such motor vehicle that is temporarily or permanently rendered unserviceable for any reason or declared to be beyond repair by

the Engineer, at no additional cost to the Employer. **The vehicles shall become the property of the Contractor on completion of the Contract**.

40 Safety & Security of Personnel & Equipment

The Contractor shall, throughout the execution and completion of the Works and the remedying of any defects therein:

(a) Will solely responsible for the safety of all persons entitled to be upon the Site and keep the Site (so far as the same is under his control) and the Works (so far as the same are not completed or completed or occupied by the Employer) in an orderly state appropriate to the avoidance of danger to such persons,
(b) the Contractor should visit the Site and get conversant with situation in this regard, and
(c) provide and maintain at his own cost all lights, guards, fencing, warning signs and watching, when and where necessary or required by the Engineer or by any duly constituted authority, for the protection of the Works or for the safety and convenience of the workers/personnel at site.

(d) Contractor shall arrange all such safety measures regarding Covid-19 as per Instructions of provincial & Federal Governments for his staff/workers and for staff of Employer/Consultants.

41 MEASUREMENT & PAYMENT OF WORK

No payment shall be made for the works involved within the scope of this section of specification unless otherwise specifically stated in the Bills of Quantities or herein.

The cost thereof shall be deemed to have been included in the quoted unit rate of other items of the Bill of Quantities.

2. HVAC DUCTING 4TH AND 5TH FLOOR SECIFICATIONS

TECHNICAL PROVISIONS

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2. HVAC DUCTING 4TH AND 5TH FLOOR SECIFICATIONS

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2. HVAC DUCTING 4TH AND 5TH FLOOR SECIFICATIONS

TECHNICAL PROVISIONS

SECTION 1 - FOUNDATIONS AND SUPPORTS

1-01 GENERAL

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

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

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

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

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

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

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

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

1-02 MOUNTING OF EQUIPMENT

1-02.1 Floor or Roof Mounted Equipment

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

1-02.2 Wall Mounted Equipment

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

1-02.3 Air Inlets/Outlets

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

1-02.4 Ceiling Suspended Equipment

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

1-02.5 Floor Mounted Equipment

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

1-03 VIBRATION ISOLATION

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

Where fans and motors are integral parts of factory assembled air handling units and the fans and motors are not spring isolated from the air handling unit, the entire unit shall be mounted on vibration isolators.

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

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

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

SECTION 2 - DUCTING AND SHEET METAL WORK

2-01 GENERAL

2-01.1 Ducting Material

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

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

The ducting for high plume fans shall be epoxy resin powder coated and shall be painted with anti-rustic and anti-fungal paint. When a powder coating process is used on fan and plenum, the coating shall be minimum thickness of 3 mils.

2-01.2 Structural Steel

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

2-01.3 Canvas Cloth

Canvas Cloth shall have specified weight with flame retardant quality.

2-01.4 Painting

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

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

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

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

2-02 DUCT CONSTRUCTION

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

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

Sheet metal ducts shall be properly braced and reinforced with steel angles, or other structural members approved by the Engineer unless otherwise required, the internal ends of all slip joints shall be installed in the direction of flow.

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

Larger Diameter of Duct (Inches)	Gauge (US)	Traverse Joint Type/Size (Inches)	Interim Bracing, Angle Size (Inches)	Maximum Spacing between Traverse Joint &/or Interim Reinforcement (Feet)
Thru 12	26	Drive Slip	-	-
13 thru 18	24	Drive Slip	-	-
19 thru 30	24	Pocket lock/1	1x1x1/8	5
31 thru 42	22	Pocket lock/1	1x1x1/8	5
43 thru 54	22	Pocket lock/1-1/2	1-1/2x1-1/2x1/8	5
	20	Pocket lock/1-	1-1/2x1-1/2x1/8	5

55 thru 60		1/2		
61 thru 84	20	Angled Reinforced Standing Seam	1-1/2x1-1/2x1/8	5
85 thru 96	18	Angled Reinforced Standing Seam	1-1/2x1-1/2x1/4	2.5
Over 96	18	Angled Reinforced Standing Seam	1-1/2x1-1/2x1/4	2.5

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

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

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

2-03 ELBOWS

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

Vertical ducts shall have full size bends where horizontal branches are taken off unless otherwise indicated, and/or approved.

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

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

2-04 HANGERS

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

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

Hangers and support system including accessories to be installed outside of the building shall be minimum made of SS316 or equivalent material.

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

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

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

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

Hangers spacing and sizes shall be as follows.

Larger Duct Diameter (Inch)	Strap Size (Inch)	Bar Diameter (Inch)	Bottom Angle Size (Inch)	Maximum Spacing (Feet)
Thru 12	1” x 22 Gauge	3/8	1x1x1/8	8

14 thru 18	1” x 22 Gauge	3/8	1-1/4x1-1/4x1/8	8
19 thru 30	1” x 18 Gauge	3/8	1-1/2x1-1/2x1/8	8
31 thru 42	1” x 18 Gauge	3/8	1-1/2x1-1/2x1/8	8
43 thru 54	1” x 16 Gauge	3/8	1-1/2x1-1/2x1/8	7
54 over	1” x 16 Gauge	½	2x2x1/4	6

Hanger rods shall be cross-braced whenever the length of rod above duct work is more than 3 ft. to prevent swing of ducts.

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

2-05 QUADRANTS FOR VOLUME DAMPERS

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

2-06 DAMPERS

2-06.1 Volume Dampers (V.D)

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

2-06.2 Splitter Dampers (S.D)

At each point of division in a supply trunk duct where a branch is taken off a trunk duct, an adjustable splitter or deflecting damper, one gauge heavier than the duct with operating rod and locking quadrant as above, shall be installed. These deflecting dampers shall be permanently set and locked in position after completion of the installation and adjustment with fans

running.

Operating rods are to be full blade length extending through the duct to externally mounted bearing plates. Construction shall be as per latest SMACNA Duct Construction Standards.

2-06.3 Fire Dampers (F.D)

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

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

2-07 FLEXIBLE DUCT CONNECTIONS

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

Flexible connections also be provided wherever ducts cross building expansion joints.

Flexible connections shall be factory fabricated of imported origin, made from chemically impregnated canvas or other material approved by the Engineer. Connections shall fit closely and are to be secured in an airtight fashion at connections to ductwork, fans and apparatus. The unclamped section of the flexible connection between apparatus and ductwork shall not be less than 6" in length. Flexible connections shall not be painted or insulated. Samples of the material shall be presented to the Engineer for approval before installation.

2-08 ACCESS DOORS AND PANELS

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

2-09 SLEEVES

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

2-10 TEST WELLS

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

2-11 FLEXIBLE ROUND DUCT & INSULATION

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

2-12 BREACHING FLUE STACK

The contractor shall provide welded steel breaching/stack for size and configuration as required and as per recommendations of the manufacturer. Fabrication shall be by welding using no less than 3.4 mm thick plate conforming to ASTM A36 or A283. Structural angle flanges for breaching and boiler connection shall be provided. Stack shall be terminated as shown on drawings and at least five (5) feet above cooling tower fan level and shall be provided with weather cap on top.

2-13 SOUND ATTENUATORS

Sound attenuators shall be designed as splitter type to be used in air ducts, air pipes and air chambers, comprising sound-absorbing elements and an external casing with flanges and mounting frames, including external heat and sound insulation if required.

The casing and flanges or frame as well as the frames of the sound-absorbing elements shall be made of galvanized sheet steel. The sound-absorbing elements shall be made of non corrosive, moisture resistant and non-combustible mineral wool, covered with acoustical transparent lagging against abrasion, made of perforated stainless sheet steel.

The sound pressure level of the air generated noise shall be lower than the required sound pressure level for the connected room by 10 dB at minimum.
All supports, hangers, etc., shall be installed sound insulated to avoid sound transmission conducted through solids.

SECTION 3 – INSULATION

3-01 GENERAL

3-01.1 The Contractor shall provide insulation for the services and equipment specified hereafter. Insulation shall be as per following Insulation Schedule.

3-01.2 Insulation material shall be complete with vapor barrier protection covering and jacketing (where specified), adhesives, insulation tape, duct sealer and/or sealing tape, fastening material, and jacketing for outdoor ducting and piping.

3-01.3 Identification bands shall be painted on insulation at frequent intervals. Lettering shall be agreed with the Engineer.

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

3-02 Insulation Schedule

No.	Services	Thickness (Inches)	Insulation Type	Vapor Barrier	Protection
a)	Indoor supply/return duct				
i)	Concealed to vision outdoor-air duct passing through conditioned space	1	Glass fiber blanket	Reinforced aluminum foil	8-Oz canvas
ii)	Exposed to vision and plant rooms	2	Glass fiber blanket	Reinforced aluminum foil	4-Oz canvas with water proof paint. Galvanized iron sheet metal

					jacketing. Additional treatment of 02 coats of epoxy resin coating, 02 coats of rust & fungus preventive paint shall also be applied to outdoor pipes.

3-03 INSULATION MATERIALS

3-03.1 Duct Insulation

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

3-03.2 Vapour Barrier for Duct

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

3-03.3 Acoustic Liner Material

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

3-03.4 Insulation Protection Material and Accessories

3-03.4.1 Canvas

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

3-03.4.2 Jacket

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

3-03.4.3 Water & Rat Proof Paint

As approved by the Engineer.

3-03.4.4 Wire Netting

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

3-03.4.5 Metal Lathe

Expanded metal lathe with 1/2 inch diamond mesh.

3-03.4.6 Banding

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

3-03.4.7 Insulation Tape

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

3-03.4.8 Adhesive

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

3-03.4.9 Duct Sealer

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

3-03.4.10 Duct Sealing Tape

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

3-04 INSULATION APPLICATION

3-04.1 General

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

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

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

the insulation and the surface to which it is applied.

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

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

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

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

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

3-04.2 Duct Insulation

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

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

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

3-04.3 Duct Insulation Protection

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

3-04.4 Insulation for Equipment having Renewable Heads

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

3-04.5 Condensate Drain Piping

Self adhesive pipe insulation tape, as specified above, shall be spiral-wrapped around pipe, with 50% overlap. The insulation shall be covered with protective covering against rusty, salty or harsh environment for outdoor application.

SECTION 4 - AIR INLETS AND OUTLETS

4-01 GENERAL

Before placing orders for these items, the Contractor shall check that all items to be supplied by the manufacturer comply for spread, throw, drop and noise, with capacities and characteristics as indicated on the drawings and schedules. All outlets shall be specifically selected for their particular application and designed for quite operation. All items are to be approved by the Engineer.

All air inlets/outlets shall be of material as indicated on the Drawings and Schedules, and/or as specified.

Colour and finish shall be subject to Engineer's approval. Ceiling diffuser face and margin sizes and styles shall be coordinated with false ceiling/boxing type. All devices shall have substantial approved gaskets to completely prevent streaking on walls or ceilings due to leakage.

Where ceiling panels and ceiling diffusers are of different size, ceiling diffuser shall be centered in ceiling panel. Duct routing may slightly be adjusted, if necessary, for this purpose or duct drops for diffuser necks may be offset upto a max. of 30 degrees. or diffuser locations having requirement of greater than 30 degrees offset, flexible round insulated duct connection shall be used.

All wooden frames for wall inlets/outlets (where not mounted directly on the duct) shall be 3/4" thick set permanently in the walls. These frames shall be provided by the Contractor. The Contractor shall be responsible for all cuttings of walls, fixing of wooden frames in walls and repair of masonry/plaster required for fixing side-wall inlets/outlets. The Contractor shall furnish wooden frames for wall inlets/outlets to those responsible for civil construction for installation at locations indicated on shop drawings prepared by the Contractor for this purpose.

Ceiling inlets/outlets shall not be supplied on false-ceiling. Cutting of false ceiling (tiles) shall be the responsibility of the HVAC Contractor.

Manufacturer's certified free area for each type and size of grille, register, linear/square diffuser and louver shall also be provided for the purpose of air balancing.

4-02 GRILLES/REGISTERS

All side wall outlets and inlets shall be of sizes and characteristics as scheduled and shown on the Drawings.

Double deflection type grilles shall have vertical front bars and horizontal back bars. Double deflection adjustable bars type registers shall have

vertical front bars and horizontal back bars.

All supply outlets shall have opposed blade dampers, finished in black paint, fixed to the outlet and shall be operatable with a removable key inserted from front of the grille.

All return and/or exhaust inlets shall have similar dampers if scheduled.

4-03 CEILING DIFFUSERS

Ceiling diffusers shall be of the sizes and characteristics as scheduled and shown on the Drawings.

Ceiling diffusers shall be furnished with volume dampers as furnished by the diffuser manufacturer, finished in black paint.

Volume control for these diffusers shall be accessible through the diffuser from below the ceiling and shall maintain their setting when adjusted. Each diffuser shall be provided with sponge rubber or felt gasket. Return diffusers shall be similar to supply diffusers unless otherwise indicated. Inner core shall be removable and shall be mounted on outer frame. (Throw pattern for supply diffusers shall be as shown on Drawings by arrows or as shown in schedule).

Ceiling diffusers intended for use with flexible round insulated duct shall have suitable inlet box.

4-04 TRANSFER GRILLES

Transfer grilles shall be of the type and characteristics as scheduled. These shall be installed on both sides of wall where no false ceiling is provided, or, where transfer grille is installed below false ceiling level unless otherwise scheduled. Transfer grilles shall be sight-tight where indicated.

4-05 EA/OA LOUVERS

All louvers shall be of approved construction as per AMCA standard 500-74. All louvers shall be fitted with aluminum mesh bird and anti vermin screens. The design of the OA inlet louver blades shall be suitable to arrest rainwater, sand and dust from incoming outdoor air. Sizes are to be as given on the Drawings. Louvers shall be complete in all respects with mounting accessories. Louvers shall be of Scheduled material and finish. Design of OA and EA louvers shall be similar. All EA louvers shall have back draft dampers upstream of louvers.

SECTION 5 - MEASUREMENTS AND PAYMENTS

5-01 GENERAL

Unless expressly excluded, the cost of all materials, equipment and works required by Special Provisions and Technical Provisions of Specifications, acceptably furnished, installed and tested as Specified, shall be considered to be included in the amounts tendered against the item listed in the Schedule of Prices for the Building Code 01.

5-02.1 SOP ITEM NO. 4

5-02.2 Measurement

No measurement will be made of the items mentioned above.

5-02.3 Payment

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

5-03 SOP ITEM NO. 1 (a and d)

5-03.1 Measurement

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

5-03.2 Payment

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

5-04 SOP ITEM NO. 1 (b and c)

5-04.1 Measurement

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

5-04.2 Payment

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

5-05 SOP ITEM NO. 2 and 3

5-05.1 Measurement

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

5-05.2 Payment

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

3. FIRE FIGHTING FM-200 SYSTEM

TECHNICAL SPECIFICATIONS

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SECTION- 5150

SPECIAL PROVISIONS

1.1 GENERAL

This specification is intended to set out general outline and the minimum requirements and standards of installation for the various units of equipment and works it covers.

This Specification shall be read in conjunction with the Bidding Drawings (as per Schedule of Drawings) and are intended to be mutually explanatory and complementary to one another. All works and specification called for by one, i.e. Specification or Drawings even if not by the other shall be fully executed and complied.

Whenever international standards are specified, the Contractor may use the better local standard subject to Engineer's approval. In the event that different standards are specified, the most applicable standard shall apply.

The contractor shall carry out detailed design and localize to suit requirements of the local Competent Authority. The contractor shall engage approved professional engineer to endorse the design and make submission to Competent Authorities for approval.

All necessary works to comply with requirements of the local Competent Authority are deemed to be included in the tender sum.

The Contractor shall be deemed to have inspected and examined the site and its surroundings and acquainted himself as to the nature of the existing works, buildings and the site, the extent and nature of works and materials or equipment required for the necessary completion of the Contract works, the means of communication and access to the site and in general obtain for himself all Bid. No claim whatsoever made by the Contractor on the grounds of want of knowledge of any of the aforesaid will be entertained.

1.2 Scope of Work

The works to be performed consists of design, supply, delivery, installation, painting, testing, commissioning, Maintenance and Warranty of the following entire fire protection system and equipment comprising:

a) Sprinkler System

b) Internal fire hose reel system

c) The entire Electrical power supply and control system to the whole fire protection system equipment including Distribution Boards, Sub-distribution Boards, isolators, power .points, control panels, wiring,

conduits, turnings and other necessary accessories. The Contractor's approved electrical professional engineer shall endorse on certificate of supervision, electrical single-lines (shop drawings and as-built drawings), testing and commissioning of the electrical related works.

d) The construction of flat 4" to 6" thick Grade 30 concrete plinths to all floor-mounted equipment (pumps, electrical supply distribution boards and control panels, etc) and concrete stumps for all piping, etc running on roof/floor.

e) Hoisting of equipment, coring/forming of openings, pipe sleeve, sealing of all openings including existing openings already provided, and fire stops, etc necessary for the successful completion of the Contract.

f) All other works necessary for the successful completion of the Contract for the full functioning of the Fire Protection systems.

g) Monthly maintenance and servicing including labor and parts replacement for the twelve (12) months defects liability period.

h) Making good all works disturbed to match existing and cleaning up on completion including patching of openings, painting, etc. to the satisfaction of the Engineer.

1.3 Minimum Qualification Requirement Of Main Contractor/Firefighting Sub Contractor

i. Registered with Pakistan Engineering Council in relevant category.

ii. Minimum experience as Contractor in the execution of at least five (05) projects of similar nature and complexity within last ten years; this experience should include supply, installation, testing and commissioning and operation & maintenance of firefighting system.

iii. Minimum experience as Contractor in execution of at least three (03) multi storey's/ hospitals/ apartments building Firefighting system of same type and capacity.

1.4 Statutory Regulations and Bye-Laws

The works and all plants, equipment materials forming part of this contract shall comply in all respect with any relevant Local Statution Regulation, Bye-Laws and other Regulation currently in force.

The contractor shall obtain and complete all notices required by the above

Authorities as necessary and shall obtain all consents necessary for the various works to be executed and shall' pay all fees in connections herewith.

All codes, acts, standards and regulations shall be the latest published edition unless otherwise stated. In addition, current Rules and Requirements of the following bodies as applicable shall be complied with:

a) Building Code of Pakistan-Fire Safety Provisions 2016

b) Installation of Sprinkler Systems (NFPA 13)

c) Installation of stationary pumps for fire protection (NFPA 20)

d) Fire Hydrant installations Part 1: System design, installation and commissioning (AS 2419.1)

e) Inspection, testing and maintenance of standpipe, Private Hydrant and hose systems (NFPA14)

f) Installation of Private Fire Service Mains and Their Appurtenances (NFPA 24)

g) Fixed firefighting systems - Hose systems Part 1 : Hose reels with semi-grid hose (BS EN 671-1)

h) Code of practice for fire extinguishing installations and equipment on premises Part 1: Hydrant systems, hose reels and foam inlets Part 2: Specification for sprinkler system (BS 5306)

i) Standard for Clean Agent Fire Extinguishing Systems (NFPA 2001 :2000)

j) Electrical Installation as per local authority requirements.

k) All other Authorities having jurisdiction over the installation of equipment and carrying out this contract works in the locality.

The work shall also be carried out strictly in accordance with the current editions of all applicable British Standards or other National Standard acceptable to the Engineer. All electrical installations and materials supplied shall comply with IEEE and Local Codes and to be approved by the Local Electricity Department or Authority.

Where discrepancy arises, the most stringent Standard shall take precedence on all matters relating to the works.

The Contractor shall bear the cost for all necessary arrangement to obtain approval for fittings, valves expansion joints, equipment and materials from the relevant authority, if required.

1.5 Noise Level, Sound and Vibration Control

All installed plants are to be reasonably quiet in operation. Preference will be given to equipment operating at low noise level.

Vibration isolators shall be installed where necessary so as to eliminate the transmission of vibration.

During initial testing operation of the installation, the Contractor is to correct for any undue noise and to make any adjustment and modifications necessary for this purpose.

Unless otherwise specified, the noise/sound level in the various areas due to operation of equipment shall not exceed the recommended standard by local Authority or ASHRAE whichever is the lowest.

Special care is to be exercised in the manufacture of equipment and installation of pipe work and outlets to keep air borne noise down to a practical minimum.

1.6 Permits and Fees

The Contractor shall procure all permits and pay all fees and charges incurred in connection with this Contract.

1.7 Shop Drawings

The Contractor shall prepare and submit to the Engineer for approval all plant and equipment layout drawings showing full details within fourteen (14) days upon award of the Contract. Detailed calculations shall be submitted where applicable. All equipment and materials proposed shall be submitted for approval.

Shop drawings shall cover complete details for the following but not limited to.

a) Operating load of all items of plant, equipment and accessories.

b) Dimensions of all plant,-equipment and accessories.

c) Equipment room layout, showing all clearances for operating and servicing, etc.

d) Control equipment and system, wiring and control diagrams and power requirements.

e) Vibration Isolation Equipment.

f) Hangers and supports

g) Foundations

h) Chases, drains with channels, openings in walls, floors, roof slab and beams.

i) Piping and electrical cable runs.

j) All other items as is reasonably required by the Engineer.

Three (03) copies of each drawing shall be submitted for approval. Drawings with inadequate details and not conforming to the requirements as stated above will not be considered.

Upon approval of the drawings, the Contractor shall deliver three (3) copies of each approved drawing to the Engineer for the purpose of Contract administration.

The drawings shall be submitted in ample time for review and approval by the Engineer and no work shall be carried out until such drawings are approved, The Contractor shall allow a period of not less than three (3) weeks for the Engineer to study the drawings for approval.

It is the obligation of the Contractor to ensure that his drawings conform to the requirements of the Specification and that they are approved by the Engineer early.

Review of shop and working drawings is not to be considered as a guarantee of measurements or building conditions. Where drawings are reviewed and approved by the Engineer, such approval does not in any way relieve the Contractor neither from his responsibility nor from the necessity of furnishing material or performing work required by the Drawings and Specification which shall in the event of a dispute, take precedence over shop drawings.

1.8 As-Installed Drawings and Manuals

Prior to the completion of the works, and not later than the date of Practical Completion, the Contractor shall submit to the satisfaction of. the Engineer six (6) hard cover bound sets of Comprehensive Operation and Maintenance Manuals and Data Sheets published by the equipment manufacturers, six (6) hard cover bound sets of "As-Installed" drawings and two (2) sets of "As-Installed" drawings (in AutoCAD -latest release) in CD-Rom subject to Engineer's approval.

These instruction manuals shall be typed in good quality paper and neatly bound into a manual having rigid covers. A draft shall be approved before

final submission.

The operation manual and As-Built drawings shall be bound with hard covers.

All "As-Installed" electrical single line drawings and control diagram shall be endorsed and signed by the Contractor's Approved Mechanical Engineer.

The manuals shall contain and be set out as follows:

a) Description of System servicing, etc.

This section shall simply but clearly describe the operation of the system and the equipment.

b) Summary of Equipment List

This section shall include all major equipment complete with makes, models, serial number with technical catalogues (at least one set to be original and others in legible print).

c) Spare Parts, Special Tools and Equipment List

Include manufacturer's list of all recommended spare parts for replacement and special tools and equipment for maintenance used.

d) Operational Procedure

This section shall fully described start and stop sequence of operation; programmed for alternate planning of plant to even out wear and testing procedures for all section of the plant including emergency procedures and breakdown trouble shooting.

e) Manufacturer’s Handbook

Include Manufacturer's technical literature on all components of the installation, particularly as applying to operation and maintenance. The technical literature shall include all major equipment, control instruments and equipment used and other related materials

f) Maintenance and Trouble Shooting Instruction

i) Equipment operation instruction
ii) Hang-up instructions
iii) Equipment suppliers

This section shall comprise a full list of names, addresses and telephone numbers (including after office hours numbers) of all Sub-Contractors and Suppliers of equipment (local and overseas) incorporated in the installation.

iv) Maintenance & Breakdown Service

This section shall comprise a list of the names and telephone numbers of Company's Maintenance 'and Servicing Section personnel for normal maintenance and breakdown request.

In the event of the Contractor failing to fulfill the aforesaid requirements, the Engineer shall reserve the right to obtain-all of the required operating and maintenance manuals by other means shall deduct all cost incurred thereof from monies due to the Contractor. In addition the Engineer shall forfeit the rights of the Contractor in relation to further payment and the issue of the Certificate Taking Over will also be withheld until he has so complied accordingly.

1.9 Spare Parts

All necessary spare parts required for two (02) years beyond defects liability period shall be included in the main bid.

1.10 Shop Inspection, Damages and Material Order

1.10.1 Shop Inspection and Damages

1.10.1.1 Inspection at Factory Premises

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

The following equipment shall be inspected and tested at the manufacturer’s works:

a) Fire Fighting Pumps

For local items inspection, Contractor will pay Rs. 2000/Day (Daily Allowance) in addition to cost of traveling, boarding or lodging for one Employers representative and one Engineer’s representative for the subject inspection.

1.10.1.2 Special Requirements for Fire Fighting Pumps

The pre shipment inspection of fire Fighting Pumps is required. The detail requirements are as below:

a) The Contractor shall import the equipment, preferably on proforma invoice issued by the local distributor. Trans-shipment will not be allowed. The Contractor may import the equipment without involvement of local distributor provided he fulfills following conditions:

A certificate from the manufacturer, on original stationery be furnished along with equipment submittal for approval, certifying that the manufacturer will be responsible to provide after-sale service through his authorized local representative. The certificate should carry the name and location of the project as well as the name and address of the authorized local distributor.

b) The Contractor shall arrange at his own cost factory visit(s) for pre-shipment inspection separately for Fire Fighting Pumps. One Engineer's representative and one Employer's representative accompany with Contractor's representative will visit manufacturer's premises. Business Class Air-fare to and from inspector's home town, boarding and lodging, and transport for two persons shall be Contractor's responsibility. The Contractor shall arrange visa for the inspectors and all formalities and costs in this respect shall also be the Contractor's responsibilities.

In addition, the Contractor shall provide (for two persons) daily allowance in US$ for out of pocket expenses at 200 US $ / day/person. The number of days shall be actual days spent in travel calculated from the dates of travel from and to the home town of the concerned inspector, but not less than five (5) days. The US$ in cash shall be provided before start of travel from hometown.

c) Technical submittal furnished in accordance with Contract provisions shall include:

Manufacturer's computer selection sheet, in original on Manufacturer's stationery stating, besides other information project name and location, make, country of origin and source of supply.

Manufacturer's Warrantee Statement on Manufacturer's stationery in original shall be submitted.

Manufacturer's confirmation on his stationery in original, acknowledging the condition that no trans-shipment would be allowed, Warrantee Statement will be part of shipping documents, and shipment will be subject to pre-shipment inspection and witnessing of performance test by two (2) representatives of the Owner at Manufacturer's factory. The Acceptance Certificate by Owner's Representatives will be part of shipping documents.

After approval of Technical Submittal for all equipment, following documentation shall be furnished.

- Attested copy of Letter of Credit (price portion may be blanked off).

- Manufacturer's confirmation on his original stationery, that the order has been entered for production. Project name, location and expected shipment date be stated.

d) In case of absence of pre-shipment inspection for any reason, Engineer may advise 3rd party inspection/testing or will deduct suitable amount of pre-shipment inspection or direct the Contractor to change the make/country of origin of the equipment if so required.

e) The Contractor is required to fill the rates of pre shipment inspection of Fire fighting pumps in item no. 31 of BOQ as per requirement of clause SP 1.9.1.2.

1.10.1.3 Inspection at Karachi Port

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

1.10.2 Material Orders

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

1.10.2.1 Acceptance of Materials

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

1.10.2.2 Damages, During Transportation, Storage and Installation

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

1.11 Addition/Omission Works

The Engineer reserves the right to add/omit any part, item, or scope of work to the Contract. Any variation will be according to the Schedule of Rates.

1.12 Building Works and Making Good of Damages

All sealing up of holes, erection of brick walls, surface finishing etc. necessary for the carrying out the installation, including making good to match surrounding finishes, shall be deemed to be included in the Lump Sum Tender Price.

All damages caused during the installation work shall be, making good by the Contractor to match the existing and surrounding finishes. All costs in connection with such work shall deem to be included in the Lump Sum Tender Price.

1.13 Training Course

The Contractor shall conduct minimum one (01) full complete comprehensive operating and maintenance training program on the operation and maintenance of the systems installed. The training programs shall include but not limited to overall systems, the familiarization of the equipment, trouble-shooting techniques for fault rectification and servicing of the systems/equipment installed. The training shall consist of all notes and materials, etc. including hands-on training as a major portion of the whole training program.

1.14 Certification Endorsement by Contractor

The Contractor shall submit hydraulic calculations and relevant documents for the fire pump, wet riser, hose reel and clean agent fire suppression systems to the Engineer for approval. All calculations and submission-materials shall be endorsed by the Contractor's approve Mechanical Professional Engineer. After submissions, hose reel pumps selection, pump curve, friction loss calculations and pump control panel shall be endorsement by the Contractor's approved Mechanical Professional Engineer.

The Contractor shall submit structural calculations and relevant documents for all water tanks installed under this Contract to the Engineer for approval. All calculations and submission materials shall be endorsed by the Contractor's approved Structural Professional Engineer.

All shop drawing and as-installed drawings on electrical single-line diagrams shall be endorsed by the Contractor's approved- Electrical Professional Engineer.

On completion of all performance testing as required in the Specification, the Contractor is required to submit all test reports to the Engineer for approval prior to acceptance of installation. The Contractor shall also be required to certify in writing to the Engineer that Installation is in full compliance with the requirements of the Specification and the Codes to which are designed by an approved Professional Engineer/Licensed Electrical Worker.

All drawings, calculations, test certificates', Certificate of Supervision, data and analysis submitted in this Contract shall be endorsed by the Contractor's approved Professional Engineer tests and inspections required by the relevant authorities for his installation works for obtaining occupation permit of the building shall be carried out by the Contractor.

This Contract shall be deemed to include for all testing requirement.

The Certification of Taking Over will not be issued unless the clauses as stated above a complied with to the satisfaction of the Engineer.

1.15 Contractor Assistance during DLP Period

The Contractor shall operate, service and maintain complete firefighting System for a period of three hundred and sixty five (365) days after date of issuance of Certificate of Completion. The system shall be operated as specified and shall include supply of operating staff, consumables, all necessary adjustments, greasing, oiling and cleaning and the furnishing of necessary tools, instruments supplies and parts to keep the system in perfect operation, except such parts made necessary by misuse or neglect not caused by the Contractor. All costs incidental to the above specified Servicing and Maintenance shall be deemed to be included in other items of the Schedule of prices and no separate payment shall be made to the Contractor for fulfillment of his obligations under this clause with respect to Servicing and Maintenance. The Contractor may withdraw maintenance tools and instruments at the completion of Defects Liability Period.

The cost of operating the plant during Defects Liability Period shall be paid by the Employer to the Contractor under BOQ item named “Firefighting System Operation during Defects Liability Period As specified”

SECTION 5150

TECHNICAL PROVISIONS

SECTION I - GENERAL REQUIREMENTS

1.1 MATERIAL

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

1.2 WORKMANSHIP

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

1.3 EQUIPMENT

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

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

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

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

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

1.4 CHASSES AND OPENINGS

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

1.5 PROTECTION

The Contractor shall keep pipe, duct and other openings closed to prevent entry of foreign matter. All fixtures, equipment and apparatus shall be covered and protected against dirt, water, chemical or mechanical damage, before and during the construction period. All fixtures, apparatus, or equipment damaged including damaged shop coats of paint shall be restored to original conditions prior to Commissioning and also again prior to Final Acceptance. All bright finished shafts bearing housings and similar items shall be protected until in service: no rust will be permitted.

1.6 CUTTING, PATCHING AND REPAIRING

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

1.7 LINES, LEVELS AND SPACES

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

1.8 MACHINERY GUARDS

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

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

1.9 TOOLS

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

1.10 OIL AND GREASES

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

1.11 SPARE PARTS

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

1.12 ACOUSTIC TREATMENT

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

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

Provision is to be made to minimize noise and vibration. However, different manufacturers equipment have varying sound and vibration characteristics

and it is, therefore, the responsibility of the Contractor to ensure that the requirements in these specifications are fully met by the equipment he is offering. If the Contractor has any requirements for additional vibration or sound isolation, these must be incorporated into the price quoted.

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

1.13 ACCESS PANELS

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

1.14 SEALING OF OPENINGS

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

SECTION – II – FIRE PROTECTION EQUIPMENT

1.0 SCOPE OF WORK

The work to be done under this section of the Specifications includes furnishing all plant, labor, equipment, appliances and materials and in performing all operations required in connection with the supply, installation, testing & commissioning of black steel pipes and fittings for firefighting system, portable fire extinguishers, fire hose cabinets, sprinklers as shown on the Drawings, as specified herein and/or as directed by the Engineer.

2.0 PIPE AND FITTINGS

2.1 Material

Seamless black steel plain end pipe shall conform to ASTM A106 & fittings shall conform to BS 534, for detail specification refer Section IV and for testing & commissioning of firefighting system refer section II.

3.0 PORTABLE FIRE EXTINGUISHERS

3.1 Materials and Equipment

Portable fire extinguishers shall be of European origin or approved equal and shall contain specified quantities and types of extinguishing agents. Extinguishers shall be classified according to type of extinguishing agents and the Class of fire types for which it is intended to be used. The extinguisher container/vessel shall be of anticorrosive material or otherwise lined internally with corrosion-resistant material. The outside surfaces of the container/vessel shall be painted with at least two coats of anti- corrosive paint. The extinguisher container shall be designed as pressure vessel and shall conform all the applicable standards of ASME pressure vessel codes. The container shall be fitted with spring-loaded pressure safety valve. The valve shall be set to blow off at 90% of container test pressure. It shall be fitted with gauge showing empty and full status.

3.2 Codes and Standards

Portable fire extinguishers shall conform to NFPA (National Fire Protection Association) of USA or FOC (Fire Offices Committee) of UK and BS 5423.

3.3 Types of Extinguishers

3.3.1 Carbon Dioxide Extinguisher

Carbon dioxide extinguisher shall-contain specified quantities of carbon

dioxide gas under pressure. The extinguisher shall have knob or lever operated valve, a short length of hose and discharge hose at the end of the hose. A siphon/dip tube shall extend from the valve to the bottom of the container. The valve shall have safety pin to prevent accidental release of the extinguishing agent.

When operated the discharge time for 6 kg carbon dioxide extinguisher shall not be less than 14 seconds and maximum range of throw shall be 5-8 meter.

3.3.2 Dry Chemical Powder Extinguisher

Dry chemical extinguisher shall contain specified quantities of dry powder chemical. The type of dry powder shall be suitable for the intended use. The extinguisher shall have knob or lever operated valve, a short length of hose and a nozzle at the end of the hose. A siphon/dip tube shall extend from the valve to the bottom of the container. The valve shall have safety pin to prevent accidental release of the extinguishing agent. The discharge pressure shall be obtained from pressurized carbon dioxide cartage attached to the body of the extinguisher. The operation of the knob or lever shall pierce the cartage to obtain the expellant pressures. When operated the discharge time of 6 kg dry powder extinguisher shall not be less than 14 second and max range of throw shall be not less than 5-8 meter.

Automatic Dry Chemical Powder Extinguishers shall have coverage area not less than 100 Sq. ft.

3.3.3 Wet Chemical Extinguisher

Wet chemical extinguisher shall contain specified quantity of wet chemical. The type of wet chemical shall be suitable for the intended use in kitchen. The extinguisher shall have knob or lever operated valve, a short length of hose and a nozzle at the end of the hose. A siphon/dip tube shall extend from the valve to the bottom of the container. The valve shall have safety pin to prevent accidental release of the extinguishing agent. The operation of the knob or lever shall pierce the cartage to obtain the expellant pressures.

When operated the discharge time of 6 ltr. wet chemical extinguisher shall not be less than 17 second and max range of throw shall be not less than 5-6 meter.

3.4 Installation

Portable fire extinguishers shall be installed at three feet height above finished floor.

Where only extinguishers are installed they shall be fixed to wall column with painted steel clamps or stored in steel or concrete in extinguisher cabinets as shown on the applicable drawings or as directed by the

Engineer. Where clamped to the wall/column the clamp shall be such that extinguisher can be conveniently fixed and removed without loss of time.

Where stored in cabinets, the cabinets shall be of steel or concrete with glazed steel door painted with at least two coats of anti-corrosive signal red enamel paint over a prime coat of red oxide paint. The locking arrangement will be such that the door can be opened from inside by breaking the glass and from outside with key.

3.5 Markings

Portable Fire extinguishers shall be painted with color code according to NFPA Standard specifications. On the body of the extinguishers shall be marked/imprinted the following information.

a) Instructions on how to use the extinguisher
b) Name of the extinguishing agent
c) Weight/volume of the extinguishing agent
d) Gross weight of the extinguisher
e) Filling pressure of the extinguishing agent
f) Classes of fires for which the extinguishing agents may be effectively used
g) Name of the manufacturer and the year of manufacture

4.0 Siamese Connection

It shall be with two B-couplings according to NFPA or another equivalent, approved standard, (65 mm diameter) with ball valves, caps, and union, installed in on galvanized sheet steel plate.

5.0 Automatic Sprinkler System

5.1 General

The sprinkler system is designed to Light Hazard.

The Contractor shall submit sprinkler system hydraulic calculations for the entire sprinkler system for the approval of the Engineer. The format of hydraulic calculation worksheets shall be approved by the Engineer and soft copies of the hydraulic calculation worksheets shall be submitted to the Engineer. All sprinklers/water spray hydraulic calculations shall be endorsed by the Contractor’s approved Mechanical Professional Engineer.

The locations of sprinkler/ spray nozzles as shown on the drawings are indicative only. The Contractor shall co-ordinate with ceiling layout and services for final sprinkler head/ spray nozzles position. No additional cost claims will be entertained for final heads position adjustment within 3m radius form the positions as shown on the drawings.

5.2 Sprinkler System

The sprinkler system shall be installed such that when any one or more of the sprinklers are in operation or when the drain/test valve of the main control valve is turned on, the pump shall start automatically. This will cause the water motor alarm and the bell to ring and indicators in the main control panel lit. The fire alarm shall also sound when actuated by the flow switches installed in the system.

5.3 Sprinkler Head

Sprinklers/water spray nozzles shall be UL and FM approved. The sprinkler heads shall be installed as shown on the drawings. The Contractor shall install sprinkler heads including sprinkler pipes teeing off from main pipes to sprinklers. Sprinklers shall be of conventional pattern designed to produce a spherical type of discharge with a proportion of water being thrown upwards to the ceiling. Sprinklers shall be designed with universal type deflector enabling the sprinkler to be erected in either the upright or pendent position. All sprinkler heads and components used shall conform to the requirement of the latest edition of the code of practice.

Sprinklers and spray nozzles shall be of Electroless Nickle plating (PTFE). Where sprinklers are likely to be accidently damaged or as shown on the drawings, the Contractor shall supply and install the protective guards or cages of approved types.

The sizes of sprinkler/ spray nozzle orifice for various hazard class and the temperature ratings for various areas shall meet the requirement of relevant code of practice.

The spacing and location of sprinklers and spray nozzles shall meet as per sprinkler layout shown on the drawings. If any deviation found to the drawing with code of practice, Contractor shall seek approval from Engineer before preceding the work.

Unless otherwise stated, sprinkler temperature rating shall be 68°C/ 79°C and shall be color coded accordingly. Sprinkler pressure head shall not be less than 15 psi and K factor shall be as specified in Schedule of prices.

5.4 Spare Sprinkler

A stock of spare sprinklers shall be provided and stored in a cabinet installed at a suitable location. A storage capacity of not less than as designated by NFPA 13 shall be provided to store the stock of sprinklers.

The number of spare sprinklers is to be in accordance with the NFPA 13. Special sprinkler wrench shall be provided in the cabinet to be used for the removal and installation of sprinklers.

6.0 Fire Hose Cabinets

The recess type/ wall mounted Cabinet shall be of 18-gauge steel of size as shown in drawing. The door shall be hinged steel glass door with locking arrangement. It shall have steel hose rack with hose which can swing 180^0 on hinges. The cabinet shall have hose valve, 100 feet (30 meter) long synthetic, double jacket lined hose for test pressure of 20 bars minimum, with diameter one triple-purpose brass nozzle as approved by fire department.

Fire Hose Cabinet shall be installed flushed with outside finishes as approved. The fire hose shall be connected to fire water system, 2" diameter with reducer and 2" x 1-1/2" hydrant valve connected to hose with instantaneous coupling and with multipurpose nozzle" as shown on drawing. The minimum pressure at the valve in cabinet shall not be less than 4.5 bars. In case the pressure at the valve exceeds 4.5 bars, the pressure shall be reduced to 4.5 bars using pressure reducing device.

7.0 MEASUREMENT AND PAYMENT

Portable Fire Extinguishers, Siamese Connection, Fire Hose Cabinets.

7.1 Measurement

Measurement of acceptably completed works of fire Portable Fire Extinguishers, Siamese Connection, Fire Hose Cabinets will be made on the basis of actual number provided and installed in position as shown on the drawing or as directed by the Engineer.

7.2 Payment

Payment will be made for acceptable measured quantity of fire hose cabinet, orifice plate, pressure reducing valve and Siamese connection on the basis of unit rate per number quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the item.

SECTION- III - PUMPING MACHINERY (NOT USED)

1.0 SCOPE

The work to be done under this section of the specifications includes furnishing all plant, labor, equipment, appliances, materials, sundries and in performing all operations required in connection with the installation of pumping machinery including all accessories as specified herein or shown on the Drawings or as directed by the Engineer.

2.0 MATERIALS AND PRODUCTS

Materials and machinery shall conform to the latest referenced specifications and other provisions specified herein and shall be new and unused. In case where manufacturers are specified, materials and equipment will be of the same manufacturers. In all other cases the Contractor shall submit the names and addresses of the Manufacturers and trade names of the materials and equipment that he intends to buy. Other information such as diagram, drawing and descriptive data will be supplied if so desired by the Engineer. Approval of materials and all the machinery under this provision shall not be construed as authorizing any deviations from the specifications. The approval of machinery of manufacturer other than that specified will be purely on the discretion of the Engineer. The Engineer will fully ascertain the facts and satisfy himself as to the performance of the machinery offered by the Contractor.

3.0 SPECIAL REQUIREMENTS OF PUMPS

The Contractor shall supply and install firefighting pumps as shown and detailed on the drawings and as per NFPA 20. The pumps shall be FM approved and UL listed. The pump coupled with motor shall be factory tested.

Each pump shall be capable of circulating the required nominal rate against the head of the system. The pump head indicated on the drawing is indicative only. The Contractor shall carry out detailed calculations relating to the pressure drop of the equipment selected by them and of the system piping so that each pump is capable of providing the necessary output at the designated head. The Contractor shall supply to consultant a licensed software for crosschecking of hydraulic calculations. Pump performance curves with the predicted operating points shown shall be submitted together with the Tender offer. It shall be the sole responsibility of the Contractor to ensure that the pump head selected is adequate for the efficient functioning of the system and to meet the design intents.

The pumps shall have stable throttling curves and be suitable for unrestricted parallel operation.

One duty pump and jockey pump shall be electrically driven and one standby pump shall be Diesel driven.

The pumps and their drives shall not overload or trip when operating against zero pressure.

The design, construction and materials shall be such that damage as a result of cavitation is completely eliminated.

Pumps shall have bearings and be suitable for continuous as well as intermittent operation without external sealing or cooling water. The pumps shall be such that they shall come into operation at once after a prolonged shutdown period without having to take special measures. Pumps shall be capable of delivering specified quantity of water at the specified pressure.

Pumps shall be tested at site before their final acceptance.

Pumps shall be installed at positions shown on the Drawings and/or as directed by Engineer.

Pumps and their drives shall be in perfect alignment when installed in position.

4.0 FIRE PUMPS

4.1 VERTICAL TURBINE PUMP, MOTOR & DIESEL ENGINE FOR FIRE WATER PUMPS

Pumps shall be Vertical Turbine type, all bronze except where other material is scheduled. The capacity of each pump shall be as specified. The shaft shall be supported by bearing and shaft sleeve at such interval that the shaft shall not twist, bend or vibrate excessively. The shaft bearing shall be water lubricated. Pressure tank of steel of required capacity shall be placed with jockey pump for fire system.

Bronze statically and dynamically balanced, closed, overhung, single suction, and keyed to shaft, and secured by a locking cap screw, replaceable bronze casing wearing ring, stainless steel shaft with bronze sleeve. Include flinger on motor shaft between motor and seals to prevent liquid that leaks past pump seals from entering the motor bearings. Mechanical seals shall be of Carbon steel Rotating ring, stainless steel spring, ceramic seating and flexible bellows and gasket.

Pump suction and discharge shall be of steel drilled to B.S 450 or B.S 10 and shall be rated for the pressure of 1.5 times the firewater pumps. Such measures shall be taken in pump designing so that no negative pressure is created at suction end.

The motor shall be fully sub-tropicalized and comply with IP 55 rating and insulation Class F. The motor shall be of such capacity that at rated voltage, the full load ampere rating will not be exceeded under any conditions of pump load.

The motor shall be totally enclosed forced cooling (TEFC) type and shall be tested in compliance with NEMA (National Electrical Manufacturer's Association) standard. The motor shall be suitable for connection to a 400V (as per Electrical design), 3-phase, 50 Hz A.C. and rated for continuous operation at ambient temperature not less than 50 deg C.

The engine shall be of 4-stroke mechanical injection air-cooled type with automatic speed regulator and flywheel housing.

The engine shall be provided with double battery kit (12 VDC) and charger, complete with exhaust pipe (insulated) and arranged to discharge outside.

The engine shall be manually switched off. Fuel supply shall be adequate for minimum two (02) hour operation.

4.2 CONTROL PANEL

4.2.1 Approvals

The Fire Pump Controller shall meet the requirements of the latest edition of NFPA 20 as well as meeting CE mark requirements. It shall be FM approved and UL listed.

4.2.2 Construction

All internal components shall be front mounted and wired for ease of inspection and maintenance. All relays shall be of the plug-in type, complete with visual indication to show that the relays are energized. The controller shall include an LCD display to indicate battery voltage and amperes as well as system pressure, in PSI or Bars.

The controller shall have twin battery chargers meeting NFPA 20 requirements. The battery chargers shall have reverse polarity protection/indication and be capable of recharging a completely discharged battery within 24 hours. The chargers shall auto detect the input voltage of either 120VAC or 220VAC and shall be able to be programmed for either 12VDC or 24VDC output.

The controller shall come standard with a breaker disconnect on the AC line and for both battery connections.

A solid state pressure transducer shall be installed in the enclosure bottom to ensure all plumbing connections are made external to the controller. The controller piping and pressure system shall be rated for operation in system pressures up to 600 PSI (42.25 kg/cm2) within +/- 1.5% accuracy.

4.2.3 Enclosure

The controller shall be housed in a NEMA Type 2 (IEC IP11), powder baked finish, free- standing enclosure.

4.2.4 Microprocessor Control

The control panel shall consist of the following control parameters:

1. Start and stop psi points
2. High and low pressure alarm set points
3. Stop mode: manual or auto
4. Run period timer: 0-60 min
5. Ac power failure: enable or disable
6. Sequential start timer: 0-300 sec.
7. Weekly test timer
8. Pressure deviation: 1-99 psi
9. Language: English

The following visual and audible alarms shall be provided:

1. Fail to start high engine temp.
2. Low oil pressure engine run
3. Engine over speed low fuel
4. Battery #1 failure charger #1 failure
5. Battery #2 failure charger #2 failure
6. Remote start deluge valve
7. Low pressure interlock on
8. Speed switch fault low suction
9. ECM selector in alt position
10. Fuel injector malfunction
11. Starter #1 failure
12. Starter #2 failure
13. Transducer failure
14. Data cable disconnect
15. DC fail

The controller shall have a 4 line by 40 character LCD display mounted on a panel opening in the front door. The LCD display shall indicate the system pressure, Battery #1/#2 voltage and amperage, operation mode, shutdown mode, custom messages, alarms, timers, date, and time. Etc.

The controller shall be supplied green status LED’s and RED alarm LEDs to indicate status and alarms mentioned above.

The microprocessor logic board shall be equipped with:

a. A J1939 Engine Communication port.
b. A USB port for transference of message history, controller status, diagnostics, and statistics and the ability to update firmware.

c. An Ethernet port for direct connection to a computer for data transfer.
d. An RS485/RS422 Modbus communication terminals.
e. RS232 Serial Port

The controller shall come complete with an embedded web page which allows viewing of the controllers' current status, data values, programmed set points, and downloadable history.

a. A Fail-to-Start alarm shall occur if the engine does not start after the crank cycle.
b. A sequential start timer, weekly test timer and AC Failure Start timer shall be provided as standard.
c. The controller shall be supplied with interlock and shutdown circuits as standard. A flashing green LED shall indicate an interlock on condition.
d. Where shutdown of the pump(s) due to low suction pressure is required, it shall be accomplished without the addition of a separate panel or enclosure. The LCD display shall indicate low suction shutdown. Resetting of the condition shall be automatic or manual as selected by the user.
e. Means shall be provided to test the operation of all LED’s to ensure their functionality.

4.3 Operation and Control

- The pumps shall be protected from dry running by low water level cut out switch.
- Power source shall be provided for batteries backup of controller in case of electric failure/shutdown.

4.4 Control Panel Features

- The pump shall be controlled by a combined manual and automatic across the line type fire pump control panel.
- Backup power source shall be provided for operation of controller in case of emergency.
- The control panel shall have an externally operated circuit breaker, a pilot light to indicate when power is on, switches or push button for manual or automatic operation, a pressure switch control for automatic operation and a remote alarm signal when pump is operating.
- The panel shall have provision for connection to BMS. The controller shall be integrated with BMS on open protocols, preferably BACnet over IP, through local areas network (LAN). For this purpose, LAN port (RJ-45) shall be available in the controller.
- Controllers to have auto program for start/stop for future periodic maintenance.
- A pressure switch and single phase failure relay with local visual indication and auxiliary contact for remote indication of 240 volt AC power failure shall be provided which will, upon drop in system pressure

or loss of single phase AC power, cause the controller to open or close all circuits necessary to automatically start the engine by performing the following functions:-

a) Turn on fuel supply.
b) Automatically alternating between the dual batteries on each cycle.
c) Disconnect cranking motor upon engine start.
d) Once the engine is started, it shall remain in operation until shut down automatically.
e) If the engine should fail to start after several cranking attempts, the controller shall disconnect all starting circuits and energize an audible and visual alarm to indicate "over crank" in the panel as well as in the engine control panel.

5.0 INSTALLATION

The fire water pumps shall be installed on concrete foundation at the specified location.

6.0 PUMP ACCESSORIES

Pumps shall be provided inclusive of the following accessories:

i) Strainer on pump suction pipe.

ii) Pump flexible connections and reducer/enlarger is necessary if the pump discharge size is different from discharge piping and the items are not given separately in the BOQ.

iii) Pressure relief valve in pump discharge

iv) Anti vibration mating

7.0 MOTOR PROTECTION

Motors of 3kw or less power shall be started direct on line. Larger motors shall be started by star-delta starter.

Motor shall be protected against under voltage over voltage, overload, over-heating and phase failure.

Motor shall be rated for normal operation against a voltage fluctuation of + 10% and frequency fluctuation of + 2Hz.

8.0 PRESSURE GAUGE

Pressure gauge shall be of copper alloy, bourdon tube type with 4” diameter dial face. The dial shall be engraved in black on white background from zero to 16 bars or 1.5 times the working pressure whichever is larger. Gauge shall be installed to socket welded to the pipeline with an isolating plug/ball valve. If the pipeline installation is such that the above

requirement cannot be met, pressure gauge of remote reading type shall be installed.

9.0 BRASS STRAINER

Brass strainers shall be of bucket type with flanged end. They shall be installed at the end of pump suction pipe. The wall thickness of the strainer shall not be less 1/8 inch (3 mm). The diameter of the holes or the width' of the slots shall not be greater than 1/4 inch (6 mm). The open area of the strainer shall not be less than 1.5 times the cross-sectional area of the suction pipe on which it is installed.

10.0 PRESSURE SWITCH

Pressure switch shall be electric actuating device, which will close/open the circuit at preset lower/higher pressures. The device shall be housed in die-cast aluminum casing with enamel finish. The switch shall be adjustable between pressures of 6-11 Bars. The pressure switch shall be rated for a working pressure of 16 Bar. The switch shall be wired to control panel.

11.0 WATER LEVEL INDICATOR

The water level indicator for high and low water level cut off shall operate on 230 Volt AC, 50 Hz and supplied complete with float, float chains, counter-weights, chain clamps, steel mounting brackets, chain guide roller and any other equipment and material necessary for installation and satisfactory operation.

The bidder may quote for non-mechanical type of water level indicator to give equivalent performance. Technical literature and data of the indicator to be furnished along with the bid documents.

12. 0 MAINTENANCE MANUALS AND TOOLS

12.1 A book or books containing the complete information in connection with the assembly, operation, lubrication, adjustment and repair of the pumping equipment, electric motor, together with detailed parts list with drawing or photographs shall be furnished in duplicate.

12.2 For the pump room, special tools necessary for maintenance and repair of the pumps and electric motors including tools kits, grease' guns etc. with accessories shall be furnished.

12.3 The manufacturer's recommended list of spare parts to be stocked by the CLIENT shall be submitted by the Contractor to the Engineer for approval. Such spare parts will also be furnished by the Contractor.

12.4 All the maintenance manuals, tools, spare parts etc., shall be supplied by the Contractor at no cost of the CLIENT and all cost shall be deemed to be included by the Contractor in his bid against item of pumping set.

13.0 MEASUREMENT AND PAYMENT

13.1 Pumping Machinery

13.1.1 Measurement

Measurement for payment of pumping machinery pressure gauge, strainer, pressure switch and water level indicator shall be the actual number acceptably provided and installed in position; the Contractor's bid against these item shall include cost of providing and installing the pumping machinery including the pumps, electric motors, all accessories, manuals, tools, spare parts, etc., as shown on the drawings, as specified herein or as directed by the Engineer.

Payment will be made for acceptable measured quantity of pumping machinery pressure gauge, brass strainer, pressure switch and water level indicator on the basis of unit rate per number quoted in the Bill of Quantities. The bid amount shall be full payment for the work specified as specified herein or as directed by the Engineer.

SECTION – IV – VALVES AND APPURTENANCES

1.0 SCOPE

The work to be done under this section of the specifications includes furnishing all plant, labor, equipment, appliances, materials, sundries and performing all operations required in connection with supply, installation, testing and commissioning of valves and appurtenances as specified herein, as shown on the drawings and as directed by the Engineer.

2.0 GENERAL

Material of valves and appurtenances shall be suitable for installation on water pipelines.

Service ratings of the valves and appurtenances shall be as specified herein, on the drawings or in the contract document but shall not be less than ***16 bars***.

All valves of size 50mm and larger shall have cast iron body and renewable bronze seal rings, bronze spindles and self-packing feature so that they can be packed while open and under pressure.

Valve ends shall be of appropriate class, material and type of the pipe/fittings to which they are to be joined.

Valves and appurtenances shall be installed in positions as shown on the drawings or as directed by the Engineer.

Before installation the interior of valves and appurtenances shall be cleaned of all foreign materials and greased. Damaged paints shall be retouched.

Before installation and after commissioning valves and appurtenances shall be Subjected to test pressure which shall be not less than 1-1/2 times the working pressure or the service pressure of the valves and appurtenances, whichever is higher and that no leakage shall be permitted during the test.

Valves and appurtenances shall be adequately supported and labeled.

Manufacturer's literature and operation manual for valves and appurtenances shall be provided.

3.0 CAST IRON GATE VALVES

Cast iron gate valves shall have flanged ends and wheel handle and shall conform to B.S.5163 "Specifications for Double Flanged Cast Iron Wedge Gate Valves for Waterworks purposes". Flanges shall be drilled to B.S. 4504 Part 1. Valves shall be rated not less than 1.5 times the system

working pressure. Valves shall close in clockwise direction.

The valve parts shall be of the following materials.

- Valve body shall be of cast iron
- Flanges shall be of cast iron
- Shaft shall be of stainless steel
- Disc shall be of cast iron with bronze trim
- Seat shall be of cast iron with bronze trim
- Disc and shaft seal shall be of rubber (O-ring type)
- Wheel handle shall be of cast iron

Valve parts in contact with water shall be of corrosion resistant material, free from toxic substances and shall not foster microbiological growth or impart taste, odor, turbidity or color to the water.

Inside surfaces of valves shall be enameled and outside surfaces shall be epoxy coated.

4.0 CAST IRON CHECK VALVES

Cast iron check valves shall be of non-slam, swing type with flanged ends shall conform to B.S. 5153, "Specifications for Cast Iron Check Valves for general Purposes". Flanges shall be drilled to B.S. 4504 Part 1. Valves shall be rated not less than 1.5 times the system working pressure. The direction of flow shall be permanently marked on the body of the valve.

- Valve body shall be of cast iron
- Flanges shall be of cast iron
- Shaft and spring shall be of stainless steel
- Disc and seat shall be of cast iron with bronze trim
- Disc and shaft seal shall be of rubber (O-ring type)
- Wheel handle shall be of cast iron

Valve parts in contact with water shall be of corrosion resistant material, free from toxic substances and shall not foster microbiological growth or impart taste, odor, turbidity or color to the water.

Inside surfaces of valves shall be enameled and outside surfaces shall be epoxy coated.

5.0 BRONZE GATE VALVES

Bronze gate valves, ball valve shall conform to B.S.5104 "Specifications for Copper Alloy. Globe, Globe Stop, Check and Gate Valve of General Purposes". Valves shall be rated not less than 1.5 times the system working pressure. Valve ends shall be screwed or flanged as shown on the drawings. Threads shall be to B.S. 21 and flanges shall be drilled to B.S. 4504 Part 1. Valve shall close in clockwise direction. Open and shut indicators shall be marked on the wheel handle.

6.0 BRONZE CHECK VALVES

Bronze check valves shall conform to B.S. 5154, "Specifications for Copper Alloy. Globe, Globe Stop, Check and Gate Valves for General Purposes". Valves shall be rated not less than 1.5 times the system working pressure. Valve ends shall be screwed or flanged as shown on the drawings. Threads shall be to B.S. 21 and flanges shall be drilled to B.S. 4504 Part 1. The direction of flow shall be permanently marked on the valve body.

7.0 ZONE CONTROL VALVES

Cast from ductile iron conforming to ASTM A-536, flanges per ANSI B 16.5, Supply Connection and System Discharge Connection. Zone Control Valve shall be designed to separate the area in case of maintenance and to get the indication of fire zone on a combination of Butterfly valve, Flow Switch, Pressure Gauge and Test & Drain Valves.

The zone control valve assembly shall consist of the following:

- Butterfly Valve
- Water flow Alarm switch
- Water flow Detector
- Test & Drain Valve
- Motor Gong
- Pressure Gauge

Zone control valve shall be connected to the main Fire control panel and fire alarm control panel through Building Management System (BMS). The control panel shall have auto, manual and off selector switch.

Valve shall be installed in vertical position in fire protection riser. Trim shall be installed as per manufacturer’s recommendations including drain and test valves. Pipe drains to hub or floor drains. Test and adjust operation of valves, alarms and pressure maintenance devices.

8.0 ALARM CHECK VALVES

Alarm check valves shall be equipped to give clear positive audible alarm at any water flow through the sprinkler system equal to or greater than that from a single automatic sprinkler. It shall be suitable for vertical/horizontal installations as per system requirement or as directed by the Engineer and for the variable pressure of water supply.

Alarm check valves shall be of flanged type designed to withstand up to working pressure of 250 psi. It shall have cast iron body and clapper hinge, bronze clapper assembly, pilot valve assembly and other moving parts.

The alarm check valve assembly shall consist of the following:

- Alarm checks Valve, with trimmings for variable pressure, open drain, Vertical installation.
- Ø 2 inches main drain valve.
- System pressure gage.
- Supply pressure gage.
- Bypass check valve.
- Alarm control and test valve.
- Retainer chamber.
- Water motor alarm gong.
- Pressure operated alarm switch to actuate a bell

Alarm check valve shall be connected to the main control panel. The control panel shall have auto, manual and off selector switch. If the selector switch is in either off or manual position, an alarm signal should be sent to the main Fire Control and fire alarm panel.

Valve shall be installed in vertical position in fire protection riser. Trim shall be installed as per manufacturer's recommendations including drain and test valves. Pipe drains to hub or floor drains. Test and adjust operation of valves, alarms and pressure maintenance devices.

9.0 DELUGE VALVE

An electric deluge system is a fixed fire protection system in which the pipe system is empty until the deluge valve operates to distribute pressurized water from open nozzles or sprinklers/hose reels.

Deluge valve shall be of flanged type designed to withstand up to working pressure of 250 psi. It shall have cast iron body and clapper hinge, bronze clapper assembly, pilot valve assembly and other moving parts.

The deluge valve assembly shall consist of the following:

- Deluge Valve, with trimmings for variable pressure, open drain, Vertical installation.
- Main drain valve.
- Diaphragm Chamber pressure gage.
- Water Supply pressure gage.
- Diaphragm Chamber connections.
- Automatic drain valve.
- System drain valve.
- Alarm Test valve.
- Manual Control station.

Deluge valve shall be connected to the main control panel. The control panel shall have auto, manual and off selector switch. If the selector switch is in either off or manual position, an alarm signal should be sent to the main Fire Control and fire alarm panel.

Valve shall be installed in vertical position in fire protection riser. Trim shall

be installed as per manufacturer's recommendations including drain and test valves. Pipe drains to hub or floor drains. Test and adjust operation of valves, alarms and pressure maintenance devices.

10.0 DRY RISER WET RISER LANDING VALVE

The Valve shall be certified as LPCB. The valves shall be corrosion resistant and field adjustable type. Valves shall be suitable for use in high pressure applications i.e. rating shall not be less than 16 bars.

Valves, whether globe or diaphragm shall be of the horizontal/ bib-nosed/ oblique or right-angle type.

11.0 ISOLATING VALVES

Isolating valves shall be supplied and fitted generally as shown on the drawing. These valves shall be of full-way, solid edge disc pattern with non-rising spindles of special brass or cast bronze fitted with detachable aluminum alloy die casting hand wheels.

All valves shall be "right-handed" i.e. they shall be so constructed that in order to shut the valve, spindle must turn clockwise. The hand wheels shall be clearly marked showing the direction of the wheel to be turned to close the valve.

12.0 SURGE RELIEF VALVES

Surge relief valves shall be spring operated globe type for continuous services conforming to ISO Standard or Equivalent. Valves body shall be of cast iron with stainless steel rim. Spring shall be of stainless or high tensile steel. Flanges shall be drilled to B.S. 4504 Part 1. Valves shall be rated not less than 1.5 times the system working pressure. Valves shall relieve pressure when the surge pressure in the system exceeds the pre-set value. The pressure will be adjustable between 6 to 9 bars.

13.0 AIR RELEASE VALVE

Air release valves shall be suitable for the liquid for which it is used. Valves body and cover shall be of malleable iron. Float and valve seat shall be of stainless steel. Valve ends shall be screwed or flanged as shown on the drawings. Threads shall be to B.S. 21 and flanges shall be drilled to B.S. 4504 Part 1.

Air release valve shall be provided at all high points to ensure adequate venting of the piping system.

14.0 INSPECTORS TEST CONNECTION

Each sprinkler shall be provided with an inspector Test Connection. The Inspectors Test Connection shall consist of one inch piping & gate valve, discharged to the outside through a ½ inch orifice on a concrete splash block. Area of splash block shall be 2.5 sft. Escutcheon plates shall be provided to cover the pipe sleeve openings.

15.0 INSTALLATION OF VALVES

Valves shall be installed either in chambers or above grade on line as shown on the drawings and as directed by the Engineer. Before installation, the interior surfaces of valves shall be cleaned of all foreign matters, inspected to ensure that all components are sound and in working condition and tested to 1-1/2 times the working pressure or the service pressure whichever is greater. After installation, valves shall be securely anchored; tested, retouched where paints have been damaged and labeled.

16.0 PRESSURE GAUGES

Pressure gauges shall be of copper alloy, bourdon tube type with four inches dial diameter. The dial shall be engraved in black or white background from 0 to 6 bars or 1-1/2 times the working pressure whichever is larger. Pressure gauges shall be installed on to the pipeline with an isolating ball valve.

17.0 FOOT VALVE WITH BRASS STRAINER

Brass strainer with foot valve shall be of bucket type with flanged end. The valve shall be installed at the end of the pump suction pipe or suction line. The wall thickness of the strainer shall not be less than 1/8 inch (3mm). The diameter of the holes or width of the slot shall not be greater than ¼" (6 mm). The open area of the strainer shall not be less than 1.5 times the cross section area of the suction pipe on which it is installed.

18.0 WATER FLOW METER

Water meter shall be of turbine/vane type. The body shall be of fine grained cast iron with baked enamel coating. Ends shall be flanged. Valve body and flange shall be rated not less than 1.5 times the system working pressure. The normal flow rate shall range from 50 cu.m/hr. to 300 cu.m/hr.

19.0 PRESSURE REDUCING VALVE

Screwed pressure reducing valve, body and screws of brass, spring, bonnet an regulation handle of high quality synthetic material, valve insert of corrosion resisting synthetic material (completely interchangeable), mesh strainer corrosion resisting synthetic material with fine mesh of stainless steel, mesh width 0.16 mm dia, strainer chamber of standard construction of shock-proof transparent synthetic material, ¼" connection for pressure

gauge on both sides of valve body, 2 pressure gauges, casing of synthetic material, dia 63 mm, ¼" connection bar, calibrated scale 0-16 bars. One double socket wrench for loosening spring and strainer chambers, including all necessary sealing, and fixing material.

20.0 MEASUREMENT AND PAYMENT

20.1 General

Except otherwise specified herein or elsewhere in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost therefore shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

- Jointing arrangement of pipe on both ends of valves, water meter including gaskets, nuts, bolts etc.
- Valves and appurtenances and anchors, sundries for the system
- Keys for operation of valves
- Steel embedded parts and label plates
- Manufacturer's literature and operation manual valves and appurtenances
- Painting of valves, water meter and appurtenances

20.2 Measurement

Measurement of acceptably completed works of all type valves, pressure gauges, water meter and brass strainer will be made on the basis of actual number of valves, pressure gauges, water meter and brass strainer provided and installed in position as shown on the drawing and as directed by the Engineer.

20.3 Payment

Payment for the acceptably measured number of valves pressure gauges, water meter and brass strainer will be made on the basis of unit rate per number for each valve, pressure gauges, water meter and brass strainer quoted in the Bills of Quantities and shall constitute full compensation for ail the works related to the item.

SECTION – V - STEEL PIPES & PIPE FITTINGS

1.0 SCOPE

The works under this section of the specifications include furnishing all plant, labor, equipment, appliances and materials, sundries and in performing all operations required in connection with the supply, installation, testing, flushing and commissioning of black steel pipes and pipe fittings as specified herein, in bill of quantities, as shown on the drawings and/or as directed by the Engineer.

2.0 APPLICABLE CODES AND STANDARDS

All works and materials under this section shall conform to the latest edition of the following applicable codes and standards. When the requirements of these specifications or the drawings exceed the code requirements, the Contractor shall be bound by the specifications and/or drawings for that requirement.

B.S. 4504: Flanges and Bolting for Pipes, Valves and Fittings." (Part 1)
B.S. 534: "Steel Pipes, Fittings and Specials for Water, Gas and Sewage."
B.S. 1387: "Galvanized/Black steel pipes and fitting."
B.S. 1965: "Butt Welding Pipe Fittings for Pressure purposes, Part 1 Carbon Steel."
B.S. 3601: "Steel Pipes and Tubes for pressure purposes, Carbon steel: Ordinary Duties."
B.S. 3063: "Dimensions of Gaskets for Pipe flanges"
B.S. 4147: "Hot Applied bitumen, based coatings for ferrous products."
B.S. 4161: "Coal tar based hot applied coating materials for protecting Iron & Steel products"
B.S. 4515: "Field welding of carbon steel pipe lines"
B.S. 21 "For threaded pipes and fittings."
ISO 898: "Mechanical Properties of Fasteners, Bolts, Screws and Studs."
C.P.2010: "Pipelines Part 2: Design and Construction of Steel Pipelines in Land."

Other authoritative codes and standards which ensure equal or higher quality than those references may also be acceptable subject to satisfaction and approval of the Engineer.

Any conflict between the requirements of this specification and those on the figures herein or in the codes, standards and specifications referred to herein shall be brought to the attention of the Engineer for resolution whose decision will be final and binding.

3.0 GENERAL REQUIREMENTS

3.1 Pipes and fittings shall be new and unused.

3.2 Where manufacturers of pipes and fittings are specified, they shall be of the same manufacturers unless otherwise approved by the Engineer.

3.3 Where more than one similar item of pipes and fittings are specified, they shall be of the same manufacturer.

3.4 The Contractor shall submit to the Engineer for approval of the following information regarding the specified/proposed items of pipes and fittings.

i. Name and address of the manufacturers
ii. Country of origin, make and model
iii. Dimensions and wall thicknesses of pipes and fittings
iv. Material and thicknesses of coating and lining
v. Factory test certificate from the manufacturers (MTC)
vi. Warranty if so provided by the manufacturers
vii. Method of jointing, testing and commissioning

3.5 Approval by the Engineer shall not be construed as authorizing any deviation(s) from the specifications unless they are specifically brought to notice of the Engineer.

3.6 Approval by the Engineer shall not relieve the Contractor from any of his contractual responsibility regarding satisfactory performance and other requirements of pipes and fittings.

4.0 SPECIAL REQUIREMENTS

4.1 Pipes and fittings shall be suitable for the intended use.

4.2 Every pipe shall be tested at the manufacturer's works to specified hydraulic test pressure. The test pressure shall be maintained for sufficiently long time for proof and inspection.

4.3 Each pipe and fitting shall be permanently marked or engraved giving the following information:

(i) Make and Nominal diameter
(ii) Class, Duty or Service (Pressure) Rating
(iii) Standards according to which the pipes and fittings have been manufactured.

4.4 Unless otherwise specified diameters of pipes and fittings shall be nominal. Actual inside and outside diameters and tolerances in diameters of pipes and fittings shall be according to the specified standards.

4.5 Pipes and fittings shall be seamless or welded as specified herein or in bill of quantities, as shown on the drawings and/or as directed by the Engineer.

If the Contractor so desires, seamless pipes and fittings may be substituted for welded pipes and fittings at no risk or cost to the owner. Where neither seamless nor welded pipes and fittings are specified, pipes and fittings shall be seamless unless otherwise approved by the Engineer.

4.6 Unless otherwise specified, service ratings of pipes and fittings shall not be less than the maximum pressure to which they will be subjected to.

4.7 Unless otherwise specified, wall thicknesses of the pipes shall be according to the class, schedule or duty of the pipes. The wall thicknesses shall be measured at locations excluding the jointing ends. The tolerances in wall thicknesses shall be according to the specified standards. Wall thicknesses of fittings shall not be less than those of corresponding pipes to which they are joined together.

4.8 Pipes and fittings ends shall be matching and compatible with each other and with the ends of valves and appurtenances to which they are joined.

4.9 Unless otherwise approved by the Engineer, pipes and fittings, jointing materials such as rubber rings, gaskets, nuts & bolts and jointing compound etc. shall be of the same manufacturers as those of the pipes and fittings.

5.0 MATERIAL

5.1 Pipe

Black steel pipes shall conform to API Standard 5L. The material of the pipes shall be having minimum yield strength of 42,000 psi and minimum ultimate tensile strength of 60000 psi for fire protection pipe.

5.2 Fittings

Dimensions of black steel fittings shall conform B.S. 534/1965.

5.3 Joints

Black steel pipes and fittings shall be joined by welding except for joining of valves and appurtenances and at locations as shown on the drawings and/or as directed by the Engineer. Welded joint shall conform to B.S. 4515. Black steel pipe flanges shall conform to specified or appropriate Table of B.S. 10. Nuts and bolts for flanges shall be of hexagon shape and shall conform to ISO 898. Gaskets shall be of flat shape and shall conform to B.S. 3063.

6.0 INSTALLATION

6.1 Transportation, Handling and Storage

The Contractor shall be responsible for proper transportation, handling (loading and unloading) and storage of pipes and fittings as per the

manufacturer's recommendations and direction of the Engineer.

Crane, rope or nylon slings, lifting beams with flattened hook scissor-dog shall be used for loading and unloading of pipes fittings. Hooks and dogs shaft be well padded to prevent the pipe being damaged and shall be fitted-with locking device. Steadying ropes essential.

Pipes and fittings damaged during transportation, handling or storage of lowering shall be rejected and replaced at the Contractor's expense storage of gaskets and jointing compound shall be under shade to prevent damage by sunlight and extreme heat.

6.2 Inspection

Pipes and fittings shall be visually inspected for any evidence damage or hair cracks. The turned ends of pipes and fittings shall be inspected for any local irregularities, which could affect the water tightness of the joint. Damaged pipes and fittings shall be rejected and replaced at the Contractor's expense.

6.3 Laying and Jointing

a) Above Ground (Unburied)

Before installation, the interior of pipes and fittings shall be thoroughly cleaned of all rust, dirt and foreign materials. Pipe and fittings shall be installed to lines and grades as shown on the drawings and/or as directed by the Engineer.

Pipe joints shall be welded unless otherwise specified and/or directed by the Engineer except for jointing valves and appurtenances and where welding is not possible. Welding shall be done by qualified and licensed welders using electric arc welding process. The welding shall develop full strength of the adjoining steel. Defective joints and joints not developing full strength shall be rejected at the risk and cost of the Contractor.

Pipes and fittings shall be properly supported by galvanized steel clamps, brackets and hangers etc. Supports shall permit unrestrained expansion and contraction. Clamps, brackets and hangers etc. shall be designed to take the weight of pipe, weight of water, seismic and wind loads.

Thrust anchors shall be provided at all changes in the pipe diameters and directions and at all branches and dead ends.

Thrust anchors shall be designed to resist maximum thrust forces resulting from the worst possible combination of working/static/test pressures, transient/water hammer pressure, and thermal expansion/contraction, seismic and wind loads.

The Contractor shall submit to the Engineer for approval shop drawings of the pipes supports and thrust anchors. The supports and anchors shall be

used only after approval by the Engineer.

Approval by the Engineer shall however, not relieve the Contactor from any of his contractual responsibility regarding safety requirements of the supports and anchors.

Pipes passing through floors, ceilings, roof, walls and columns in non-water retaining structures above ground or water table shall be encased in black steel pipe sleeve. The annular space between the pipes and the pipe sleeves shall not be less than one inch. The annular space shall be filled with approved packing material and sealed at both ends with approved fire rated sealant.

Pipes passing through water retaining structures above or below ground and non-water retaining structures below water table shall be provided with leak proof puddle flange. The flange diameter shall be larger than the outside diameter of the pipe by at least 4” for pipe diameters 6” and smaller and by at least 6” for pipe diameters larger than 6”.

After installation, pipes, fittings, pipe supports and thrust anchors shall be painted with two coats of red oxide or zinc chromate primer and two coat of synthetic enamel paint of approved quality.

7.0 TESTING

After laying each section of pipeline as convenient to the contractor or as necessary in the Engineer's opinion, shall be tested for hydrostatic pressure. Field hydrostatic test pressure shall not be less than 1-1/2 times the maximum pressure to which the system will be subjected to.

Before testing, pipe section shall be cleaned and their ends shall be closed with blank flanges, plugs or caps. The closed ends shall be anchored against thrust forces. Valve air vent outlet shall be installed at the upper end of the pipe section and valve water inlet fitting shall be installed at the lower end of the section. Pressure gauge certified from any approved laboratory shall be installed at both lower and upper ends of the pipe section. An isolating ball valve shall be fitted between the pipe section and the gauges.

Sufficient backfill material shall be placed over the centre section of each pipe (leaving the joints exposed) to allow inspection of the pipe joints under the test pressure. All permanent anchors shall be in positions and shall have developed adequate strength before the testing begins. The pipe section under test shall be filled with water from the inlet fitting, taking care that all air is displaced through the vent outlet.

After filling, the pipeline shall be left under small pressure for 24 hours as directed by the Engineer in order to wet the pipe and the pipe joints. After the wetting period, additional water shall be introduced into the pipe section until the test pressure is achieved when the pipe section shall be closed.

The test pressure shall be maintained for at least two hours or for a period as directed by the Engineer. Pressure gauges shall be read at maximum intervals of 15 minutes during the test period.

If the pressure measurements are not made at the lowest point of the section, an allowance shall be made for the static head between the lowest point and the point of measurement to ensure that the specified works test pressure is not exceeded at the lowest point.

If a drop in pressure occurs, additional quantity of water shall be introduced into the pipe section in order to re-establish the test pressure. The additional quantity of water introduced into the pipe section shall be accurately measured.

During the test period all joints shall be inspected. If any abnormal movement, distortion, squirm or leakage is detected, the test pressure shall be relieved immediately and the defects shall be rectified in consultation and with the approval of the Engineer.
After rectification of the defects, the pipe section shall be re-tested.

The test will be considered to have passed, if the quantity of water required to be added the test pressure does not exceed 100 liters per day, per meter of diameter and per kilometer of pipeline for each 30 meters head of test pressure.

8.0 FLUSHING

After installation and testing pipelines shall be flushed with water until all dust, dirt, scales and extraneous matters are removed from the inside of the pipeline. During flushing all valves and appurtenances shall be closed and open several times.

9.0 COMMISSIONING

After successful completion of testing and flushing duly approved by the Engineer, pipelines shall be commissioned. All valves and appurtenances shall be set at proper openings and all parameters shall be set at specified or manufacturers' recommended values.

10.0 PIPEWORK SUPPORTS

All pipe work supports shall be of mild steel rolled sections and shall be painted with two coats of approved rich metallic zinc primer. Straps, rods and hangers shall be of mild steel when used for galvanized steel pipes.

Straps shall be provided on all pipe supports. Straps shall have a pair of nut and washers on each leg with the supporting steel flange clamped tight between the pair of nuts to form a rigid guide allowing the pipe to slide axially.

Horizontal pipe work along 'walls shall be supported on channel frames securely fixed to the column. All pipes shall be arranged to slide on the pipe supports and straps shall be provided to form a rigid guide.

Vertical pipe work shall be supported at the base or at anchor point to withstand the total weight of the riser. Brackets from risers shall not be used as a means of support for the riser.

Pipe work supports shall be so designed and installed as to allow free movement due to expansion and contraction. Supports shall be anchor to steel or reinforced concrete column, wall, beam or slab.

Each support shall be able to carry independently its all the operational loads of pipe work and water.

All pipes shall be individually supported. Pipes shall not hang from other pipes. Points at which pipes pass through walls, floors, connections to plan equipment and heat emitters, etc. do not constitute points of supports for the pipes.

Provide suitable and substantial hangers and supports for all piping. As a minimum for metallic pressure piping, support schedule shall be as follows:

Pipe Size	**Maximum hanger spacing (feet)**	**Rod Sizes (inches)**
1 inch and smaller	6	3/8
1-1/4 inch to 2 inch	8	3/8
2-1/2 inch to 4 inch	10	3/8
5 inch and larger	12	1/2

11.0 MEASUREMENT AND PAYMENT

11.1 General

Except otherwise specified herein or elsewhere in the Tender/Contract Documents, no measurement & payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities related to the section.

11.1.1 Cutting, welding, jointing and laying including jointing materials such as rubber rings, gaskets, nuts and bolts, jointing compounds, welding electrodes etc.

11.1.2 Protective painting, coating, lining and wrapping

11.1.3 Testing, flushing and commissioning

11.1.4 Pipe work supports such as clamps, brackets, hangers etc.

11.1.5 Cutting and breaking of concrete and then making it good.

11.2 Measurement and Payment

Refer Section 1

SECTION – VI- FM 200 SYSTEM

1.0 General

Provision of gas based fire suppression system shall be complete in all respects as per applicable NFPA standards including but not limited to Automatic gas Flooding System (Clean Agent).

1.1 Automatic Gas Flooding System

1.1.1 General

The design and installation shall fully comply with NFPA 2001. The Contractor shall submit complete design and layout for automatic gas flooding system as per layout of the rooms.

The clean agent is discharged after a time delay upon detection of fire to warn any occupant to evacuate the room. Thus, this system can be installed in manned areas or semi-manned areas, that is, areas that are occasionally or periodically occupied.

A complete clean agent suppression system shall consist of charged FM-200 gas storage cylinder(s), manifold(s), flexible hose(s), pressure gauge(s), pneumatic actuator(s), solenoid actuator, piping, nozzle(s) and all other equipment required for a complete operational system including gas control panel, self-contained breathing apparatus, detector(s), flashing light(s), key switch(s), alarm bell(s) etc. including any sundries required for system completion and satisfactory performance..

Unless otherwise specified, automatic gas flooding systems shall be of the total flooding type with a high pressure open-ended piping installation on the distribution side. The automatic gas release mechanism shall be operated by means of fire detection units at the protected compartment or manually by a pull handle or push button.

HFC-227ea as specified shall be used as extinguishing agent.

1.1.2 Design Requirements

The FM-200 suppression system installation shall be made in strict accordance with the
drawings, specifications and applicable NFPA and FM/UL standards.

The design and installation of the FM-200 system shall be based on manual/automatic
release total flooding principle of approved/listed systems.

The system shall provide an FM-200 agent minimum design concentration of 6.25-7% by volume for protected spaces, at the minimum anticipated temperature

within the protected area. FM-200 system will have capability to integrate with Building's main Fire Alarm Control panel (FACP).

The Contractor's approved Professional Engineer shall ensure that the design of the system be such that a uniform design concentration is achieved throughout the protected area as stated by calculation using an approved listed software program for engineered system.

The quantity of the clean gas shall be carefully pre-determined to ensure fastest extinction of any fire in the protected areas as well as to ensure an adequate margin of safety to cater for leakage and environmental conditions. The Contractor shall submit the complete catalogue, technical information, samples and complete with software based calculations for Engineers approval before installation. All layout drawings, design calculations shall be endorsed by the Contractor's approved Mechanical Professional Engineer. '

The following design data shall be submitted at tender stage as the minimum requirement:

- Number and size of cylinder(s)
- Total agent and designed concentration (kg / %)
- Pipe schedule
- Automatic control system

The design, supply and installation shall be made in strict accordance with the approved working drawings, specifications and applicable standards. Agent quantity shall be calculated as per space requirements including raised floor and false ceiling area (if applicable).

The capacity and quantity of clean agent, cylinders, nozzles piping etc. is tentative. Prior to installation, Contractor shall submit complete set of calculations on manufacturer's software for Automatic flooding system, piping quantities all other equipment/material with accessories for all rooms as per site condition for approval of Engineer.

1.1.3 Extinguishing Agent

The extinguishing agent shall be HFC227ea with physical properties conforming to NFPA 2001 or ISO 14520 standard.

1.1.4 HFC 227ea

HFC227ea Fire Suppression agent is a liquefied compressed gas and dispensed into the hazard as a colorless, eclectically non-conductive vapor that is clear and

does not obscure vision. It leaves no residue and has acceptable toxicity for use in occupied spaces at design concentration.

The system pressure shall not be higher than 42 bar.

1.2 Hazard to Environment

The agent to be used shall not be made obsolete in the near future and with atmospheric life time not more than 42 years'. The agent shall be non-global warming and non-ozone depleting.

1.3 Hazard to Personnel

The areas to be protected are occupied by personnel(s) and there is a possibility that the
personnel might be trapped inside the protected areas. The agent to be proposed shall not pose any hazard to personnel(s) or force them to breathe faster artificially by introducing carbon dioxide gas in the extinguishing agent.

1.4 Gas Storage Cylinders

The cylinders shall be supported securely in frames bolted to the wall. The mounting of the cylinders shall be such that all external parts can be readily inspected.

Each cylinder shall be fitted with an automatic pressure release device which shall function when the pressure of the liquid within the cylinder exceeds a predetermined value, which shall be less than the test pressure defined in BS 5045 or equivalent.

Carbon dioxide cylinders shall be of seamless steel construction to BS 5045: Parts 1 or equivalent.

Each cylinder shall complete with gas valve/actuator, pressure gauge, flexible hose, check valve and all other necessary accessories.

A reliable means of indication, other than weighing the cylinder, shall be provided for measuring the amount of liquid in the cylinder at any time. This shall be done by a method which does not require the cylinder to be detached from the remainder of the plant.

The liquid shall be discharged from the cylinder through a siphon tube. The pressure of the liquid stored in the cylinder shall be such that freezing cannot take place at the lowest possible ambient temperature.

Means shall be provided to prevent gas discharging into empty containers and to prevent loss if the gas is released when any of the cylinders is disconnected.

Safety latches shall be provided in each bank of gas cylinders to prevent

accidental discharge of gas during maintenance. Safety latches shall incorporate a set of contacts to initiate a warning at the control panel that the system has been locked off.

Gas cylinders shall be painted signal red as specified in BS 381C. The type of extinguishing agent, tare weight, gross weight, liquid level at 21°C for HFC227 shall be clearly painted on each cylinder with white paint.

In case of minor leak of a cylinder, which mostly occurs at the top of the cylinder in areas such as valve threads, pressure safety device, valve stem and valve outlet, the following information may apply to the remediation of these minor leak:

- For flammable or inert gases, move the cylinder to an isolated and well-ventilated area away from combustible material.

- For corrosive and toxic gas, move the cylinder to an isolated well-ventilated area and use suitable means to direct the gas into an appropriate chemical neutralizer.

- If it is necessary to move a leaking cylinder trough populated area, place a plastic bag, rubber shroud or similar device over the top and tape it (duct tape preferred) to the cylinder to confine the leaking gas.

In case of major leak, such as a large gas release or if an accident takes place, the best is to alert emergencies authority, evacuate the area, securing entrances and providing assistance to the others on the way out.

Alarms system exists for pressure loss of extinguisher gas cylinder. There operate when a leakage in any gas cylinder is detected. An alarm sounds when a leak is detected and may close the valve of the gas cylinder.

1.5 Evacuation of Extinguishing Gas

Rooms that have gas-extinguishing systems will be connected to a purge ventilation system, with an extract fan in the plant room. Following a release of extinguishing agent, the extract fan will be operated manually to purge the room of gas. Ventilation systems serving these areas will also be fitted with motorized dampers, which automatically close and shut down the associated system on an alarm within the area, prior to gas being released. A local control panel will be provided, mounted outside of the protected room, adjacent to the gas system control panel.

1.6 Cylinder Bracket

Each cylinder assembly shall be furnished with wooden spacer(s) and a bracket

made of hot-dipped galvanized steel. The bracket shall hold the cylinders in a saddle with a front wooden piece that secures the cylinders well. The brackets shall be modular in design to allow added bracketing or stacking of cylinders depending on installation requirements.

1.7 Selector Valves

For system utilizing selector valves, it shall be opened pneumatically before gas discharged from any cylinder, manual activation of each selector shall be possible.

1.8 Valve Actuator

Solenoid valve shall be of brass construction and stackable design with swivel connections to allow removal of actuators for maintenance or testing. Operation of actuators shall not require replacement of components. No electro explosive device shall be used to actuate the valve assembly. Electric actuator shall be the magnetic latch, continuous duty type for 24VDC operation.

All actuators shall be able to be manually reset and capable of being functionally tested at the quarterly service intervals without the need to replace consumable parts. Actuation devices to be used shall be listed by an internationally recognized approval bod for use with the FM-200 gas fire suppression system.

1.9 Discharge Hose

When manifold(s) is employed, all cylinder assemblies shall include flexible discharge hoses, which connects cylinder discharge valve to manifold inlet. All hose shall be approved for use.

1.10 Discharge Nozzles

Engineered discharged nozzles shall be provided within the manufacturer's guidelines to distribute the FM-200 agent throughout the protected spaces. The nozzle body shall have discharge outlets designed to provide a multi-directional and even-distribution discharge pattern.

Orifice(s) opening diameter shall be determined by an approved computer software programmer in order to deliver the required amount of agent within the designed discharge time.

Nozzles shall be permanently marked with the manufacturer's part number and also the orifice diameter accordingly. Nozzle spacing shall be in accordance with the UL listing and/or FM approval.

1.11 Inspection Testing & Commissioning

1.11.1 General

All defects and deficiencies in performance, reliability, safety and efficiency shall be rectified and tested to the entire satisfaction of the Engineer before acceptance.

Before hand over of the system to the Employer, all gaseous containers shall be fully charged.

1.11.2 Inspection

The completed installation shall be inspected by authorized agent and trained personnel.

The inspection shall include a full operational test of all components as per the equipment manufacturer's recommendations during warranty period.

All mechanical and electrical components shall be tested according to the manufacturers recommended procedure to verify system integrity.

Inspection shall include a complete checkout of integration and controls equipment. The detection I control system and certification of cylinder pressure. The quantity of agent shall reflect the actual design quantity of the FM-200 gas.

1.11.3 Test Mode

The system shall be tested according to the design mode of operation in the presence of an engineer that is certified by the Principal Supplier of the FM-200 gas fire suppression system.

1.12 Steel Pipes & Pipe Fittings

1.12.1 General Requirements

a) Pipes and fittings shall be new and unused.

b) Where manufacturers of pipes and fittings are specified, they shall be of the same manufacturers unless otherwise approved by the Engineer.

c) Where more than one similar item of pipes and fittings are specified, they shall be of the same manufacturer.

d) The Contractor shall submit to the Engineer for approval of the following information regarding the specified/proposed items of pipes and fittings:

   i. Name and address of the manufacturers

   ii. Country of origin, make and model

iii. Dimensions and wall thicknesses of pipes and fittings

iv. Material and thicknesses of coating and lining

v. Factory test certificate from the manufacturers (MTC)

vi. Warranty if so provided by the manufacturers

vii. Method of jointing, testing and commissioning

e) Approval by the Engineer shall not be construed as authorizing any deviation(s) from the specifications unless they are specifically brought to notice of the Engineer.

f) Approval by the Engineer shall not relieve the Contractor from any of his contractual responsibility regarding satisfactory performance and other requirements of pipes and fittings.

1.12.2 Special Requirements

a) Pipes and fittings shall be suitable for the intended use.

b) Every pipe shall be tested at the manufacturer's works to specified hydraulic test pressure. The test pressure shall be maintained for sufficiently long time for proof and inspection.

c) Each pipe and fitting shall be permanently marked or engraved giving the following information:

(i) Make and Nominal diameter

(ii) Class, Duty or Service (Pressure) Rating

(iii) Standards according to which the pipes and fittings have been manufactured.

d) Unless otherwise specified diameters of pipes and fittings shall be nominal. Actual inside and outside diameters and tolerances in diameters of pipes and fittings shall be according to the specified standards.

e) Pipes and fittings shall be seamless or welded as specified herein or in bill of quantities, as shown on the drawings and/or as directed by the Engineer. If the Contractor so desires, seamless pipes and fittings may be substituted for welded pipes and fittings at no risk or cost to the owner. Where neither seamless nor welded pipes nor fittings are specified, pipes and fittings shall be seamless unless otherwise approved by the Engineer.

f) Unless otherwise specified, wall thicknesses of the pipes shall be according to the class, schedule or duty of the pipes. The wall thicknesses shall be measured at locations excluding the jointing ends. The tolerances in wall

thicknesses shall be according to the specified standards. Wall thicknesses of fittings shall not be less than those of corresponding pipes to which they are joined together.

g) Pipes and fittings ends shall be matching and compatible with each other and with the ends of valves and appurtenances to which they are joined.

h) Unless otherwise approved by the Engineer, pipes and fittings, jointing materials such as rubber rings, gaskets, nuts & bolts and jointing compound etc. shall be of the same manufacturers as those of the pipes and fittings.

1.12.3 Material

a) Pipe

Black steel pipes shall conform to API Standard 5L. The material of the pipes shall be having minimum yield strength of 42,000 psi and minimum ultimate tensile strength of 60000 psi for fire protection pipe.

b) Fittings

Dimensions of black steel fittings shall conform B.S. 534/1965.

c) Joints

Black steel pipes and fittings shall be joined by welding except for joining of valves and appurtenances and at locations as shown on the drawings and/or as directed by the Engineer. Welded joint shall conform to B.S. 4515. Black steel pipe flanges shall conform to specified or appropriate Table of B.S. 10. Nuts and bolts for flanges shall be of hexagon shape and shall conform to ISO 898. Gaskets shall be of flat shape and shall conform to B.S. 3063.

1.12.4 Installation

a) Transportation, Handling and Storage

The Contractor shall be responsible for proper transportation, handling (loading and unloading) and storage of pipes and fittings as per the manufacturer's recommendations and direction of the Engineer.

Crane, rope or nylon slings, lifting beams with flattened hook scissor-dog shall be used for loading and unloading of pipes fittings. Hooks and dogs shaft be well padded to prevent the pipe being damaged and shall be fitted-with locking device. Steadying ropes essential.

Pipes and fittings damaged during transportation, handling or storage of lowering shall be rejected and replaced at the Contractor's expense storage of gaskets and jointing compound shall be under shade to prevent damage by sunlight and extreme heat.

b) Inspection

Pipes and fittings shall be visually inspected for any evidence damage or hair cracks. The turned ends of pipes and fittings shall be inspected for any local irregularities, which could affect the water tightness of the joint. Damaged pipes and fittings shall be rejected and replaced at the Contractor's expense.

c) Laying and Jointing

Before installation, the interior of pipes and fittings shall be thoroughly cleaned of all rust, dirt and foreign materials. Pipe and fittings shall be installed to lines and grades as shown on the drawings and/or as directed by the Engineer.

Pipe joints shall be welded unless otherwise specified and/or directed by the Engineer except for jointing valves and appurtenances and where welding is not possible. Welding shall be done by qualified and licensed welders using electric arc welding process. The welding shall develop full strength of the adjoining steel. Defective joints and joints not developing full strength shall be rejected at the risk and cost of the Contractor.

Pipes and fittings shall be properly supported by galvanized steel clamps, brackets and hangers, etc. Supports shall permit unrestrained expansion and contraction. Clamps, brackets and hangers etc. shall be designed to take the weight of pipe, weight of water, seismic and wind loads.

The Contractor shall submit shop drawings of the pipes supports and thrust anchors to the Engineer for approval. The supports and anchors shall be used only after approval by the Engineer.

Approval by the Engineer shall however, not relieve the Contactor from any of his contractual responsibility regarding safety requirements of the supports and anchors.

Pipes passing through floors, ceilings, roof, walls and columns in non-water retaining structures above ground or water table shall be encased in black steel pipe sleeve. The annular space between the pipes and the pipe sleeves shall not be less than one inch. The annular space shall be filled with approved packing material and sealed at both ends with approved fire rated sealant.

Pipes passing through water retaining structures above or below ground and non-water retaining structures below water table shall be provided with leak proof puddle flange. The flange diameter shall be larger than the outside diameter of the pipe by at least 4" for pipe diameters 6" and smaller and by at least 6" for pipe diameters larger than 6".

After installation, pipes, fittings, pipe supports and thrust anchors shall be painted with two coats of red oxide or zinc chromate primer and two coat of synthetic enamel paint of approved quality.

1.12.5 FLUSHING

After installation and testing pipelines shall be flushed with water until all dust, dirt, scales and extraneous matters are removed from the inside of the pipeline. During flushing all valves and appurtenances shall be closed and open several times.

1.12.6 COMMISSIONING

After successful completion of testing and flushing duly approved by the Engineer, pipelines shall be commissioned. All valves and appurtenances shall be set at proper openings and all parameters shall be set at specified or manufacturers' recommended values.

1.12.7 PIPEWORK SUPPORTS

All pipe work supports shall be of mild steel rolled sections and shall be painted with two coats of approved rich metallic zinc primer. Straps, rods and hangers shall be of mild steel when used for galvanized steel pipes.

Straps shall be provided on all pipe supports. Straps shall have a pair of nut and washers on each leg with the supporting steel flange clamped tight between the pair of nuts to form a rigid guide allowing the pipe to slide axially.

Horizontal pipe work along 'walls shall be supported on channel frames securely fixed to the column. All pipes shall be arranged to slide on the pipe supports and straps shall be provided to form a rigid guide.

Vertical pipe work shall be supported at the base or at anchor point to withstand the total weight of the riser. Brackets from risers shall not be used as a means of support for the riser.

Pipe work supports shall be so designed and installed as to allow free movement due to expansion and contraction. Supports shall be anchor to steel or reinforced concrete column, wall, beam or slab.

Each support shall be able to carry independently its all the operational loads of pipe work and water. All pipes shall be individually supported. Pipes shall not hang from other pipes. Points at which pipes pass through walls, floors, connections to plan equipment and heat emitters, etc. do not constitute points of supports for the pipes.

SECTION –VII - BALANCING, TESTING AND COMMISSIONING

1.0 SCOPE OF WORK

The work under this section of specifications includes furnishing all plant, labor, equipment, appliances and materials and performing all operations required in connection with testing and commissioning of all water line, firefighting equipment and system etc. in parts and as a whole as specified herein or as shown in the Contract Documents or as directed by the Engineer.

2.0 GENERAL

The Contractor shall submit methodology and provide a complete set of testing equipment for the proper and complete testing of the system.

The instruments, equipment and labor required for conducting these tests and demonstration shall be provided by the Contractor.

The Contractor shall supply all material and labor and provide all notices and pay all fees in connection with all necessary tests to be carried out to the approval of the relevant authorities and the Engineer.

The installation shall be under the charge of the Contractor during the commissioning period, at which time the Contractor shall advise the corporation in all matters regarding the commissioning, operation, maintenance, servicing and trouble shooting of the system.

The testing shall include a complete visual inspection of the whole fire fighting system and verification or performance as stipulated in the material specification and of correct functioning of the electrical and control systems.

All supply documents, operating instructions, acceptance documentation and maintenance regulations shall be checked to ensure that they correspond with equipment described and also all certificates such as that of the inspection authorities, test certificates and data about quality, temperature and pressure shall be submitted.

3.0 FIRE FIGHTING SYSTEMS

3.1 Pumps

All pumps shall be checked for flow rates, pressures and RPM.

3.2 Hydrostatic And Leakage Test

The fire water line shall be tested in sections as the laying proceeds. All joints shall be left exposed for inspection during testing.

Pipes with cement lining shall be allowed to stand full of water for at least 24 hours before proceeding with the test.

Any leakage shall be measured by the quantity of water pumped into the main in that time. The leakage shall not exceed 0.2 per millimeter of pipe diameter per kilometer of pipe line at each 100 meter test pressure head for every 2 hours test duration. Any visible individual leak shall be repaired.

3.3 Pipe Work

All water pipe work shall be hydro-statically tested to 16 bars or 1.5 times the working pressure whichever is greater and this test pressure shall be maintained for 24 hours. During this test, all welded joints shall be hammered.

3.4 Flow Switches

All flow switches shall be tested after installation. All switches shall be correctly set to the satisfaction of Engineer.

3.5 Test Records

At the completion of the installation, the Contractor shall submit four (04) copies of the records of test.

3.6 Reliability Tests

When the preparatory tests have been concluded successfully and the Contractor has notified the Engineer that the installation is ready to work, each section of the installation will be required to operate either continuously or intermittently as may be required without failure of any kind for period of one calendar month.

Should any failure occur due to, or arising from, faulty fittings, materials or workmanship, the reliability test period of one calendar month shall be recommended after the Contractor has remedied the cause of failure to the satisfaction of the Engineer.

4.0 MEASUREMENT AND PAYMENT

No payment shall be made for the works involved within the scope of this section of specification unless otherwise specifically stated in the Bills of Quantities or herein. The cost thereof shall be deemed to have been included in the quoted unit rate of other item of the Bills of Quantities.

SECTION - 8001

4. GENERAL SPECIFICATIONS FOR ELECTRICAL SYSTEMS

1.0 SCOPE OF WORK

The scope of this contract covers all operation and activities required for proper and complete construction of internal/building electrification, external electrification & sub-station works and communication systems.

All equipment shall comply with the standard ANSI/ASHRAE/IESNA 90.1-2010 for scoring points in LEED evaluation and subsequent Platinum LEED award. After the completion of final design the contractor shall perform Load Modelling through a professional load modeler as per latest LEED manual to ensure targeted energy saving.

The works related to the Electrical & Communication systems that are included in the scope of this Contract are shown on the Drawings, stated in the Bill of Quantities and explained in these specifications. All the equipment & allied accessories and their installation shall also comply with General Specifications described here-under, with other relevant provisions of Document and WAPDA/other utilities' latest Specifications/Standards. Electrical & Communication systems shall broadly include but not limited to the following:

- Design, manufacturing, supply, installation, testing and commissioning of Lighting fixtures/Luminaries

- Design, fabrication, manufacturing, supply, installation, testing and commissioning of the 11kV 450 MVA 50 Hz Medium Voltage Switchgear

- Supply, installation, testing and commissioning of the MV 15kV three core Cross Linked Polyethylene Power cables in underground pipes or cable trenches.

- Design, fabrication, manufacturing, supply, installation, testing and commissioning of the Low Voltage 400 Volt three phase and 250 Volt single phase switchgears.

- Supply, installation, testing and commissioning of the Low Voltage Single core/multicore PVC/PVC & PVC/SWA/PVC Copper conductor cables in Cable trenches, underground pipes, on cable trays.

- Design, fabrication, manufacturing, supply, installation, testing and commissioning of the 11Kv 50Hz Diesel Generator sets

- Design, fabrication, manufacturing, supply, installation, testing and commissioning of the Type 11/0.400 kV 50 Hz Indoor/ Outdoor Dry Type / oil type Transformers

- Supply, installation, testing and commissioning of the Earthing of Electrical system.

- Supply, installation, testing and commissioning of the Maintenance Bypass Switch.

- Design, Supply, installation, testing and commissioning of the Control Panel, Smoke Detectors, Heat Detectors, Manual Call Point and Audio Alarm etc for complete Fire Detection & Alarm system.

- Each DG set and Energy Monitoring system shall have the provision to integrate with the Integrated Building Management System (IBMS) for local and remote monitoring.

The scope shall include the continuing of the contractor to remain responsible for removal of defects detected in the works and for achieving satisfactory operation/functioning/service of the works during defect liability period.

The contract shall include furnishing of all construction equipment, tools, labour, supervisory staff, plants, transport, power, testing apparatus/arrangements and all construction materials as shall be required for satisfactory completion of works strictly in accordance with the technical specifications and bill of quantities forming part of these documents and as per levels and dimensions as shown on the drawings supplied with these documents and in drawings which may be supplied by the Employer from time to time under approved variation orders.

The Contractor shall also be responsible to supply any other equipment not specifically mentioned in these Documents but which is necessary for proper operation of the works/ system included in the scope of this Contract. The Contractor shall solely be responsible for ensuring proper functional requirements of various equipments. He shall also be responsible for furnishing any additional piece of equipment and for making modification in the equipment as desired and/or approved by the Engineer to achieve proper co-ordination with various other equipment's offered in the bid and also with those installed by others.

2.0 RULES & REGULATIONS

The entire Electrical & Communication systems installation/work shall be carried out by licensed Contractor, authorized to undertake such work under the provisions of the Electricity Act 1910 and The Electricity Rules 1937 as adopted and modified upto date by the Government of Pakistan.

All works shall be carried out in accordance with the latest edition of the Regulations of the Electrical Equipment of Buildings issued by the Institute of Electrical Engineers-London, 16thed. NEC 1999, the Contract Documents, the Electricity Rules 1937 and bye-laws that are in force from time to time.

Any discrepancy between these specifications and the standards/ regulations shall be brought to the notice of Engineer for his instructions and decision of the Engineer shall be final and conclusive.

The Contractor shall be responsible for completing all formalities and submitting the test certificates as per prevailing rules and regulations, and shall have the installation passed by the Government Electric Inspector of that region. All requirements of the Electric Inspector and the utility company WAPDA shall be complied with.

3.0 AMBIENT CONDITIONS

All material and equipment supplied and installed shall be designed, manufactured and tested to meet the following ambient conditions unless specifically stated otherwise for any material/equipment.

Minimum indoor ambient temperature:	Zero Degree Celsius
Maximum indoor ambient temperature:	+ 40 Degree Celsius
Minimum outdoor ambient temperature:	Zero Degree Celsius
Maximum outdoor ambient temperature:	+ 50 Degree Celsius
Maximum Relative Humidity:	90 Percent
Minimum Relative Humidity:	10 Percent

The atmospheric conditions are tropical and arid.

4.0 MARKINGS

The Contractor shall provide "Danger Boards" and "Shock Charts", wherever required, to comply with the requirements of local Electricity Rules and according to normal practice.

5.0 SYSTEM DATA

Unless otherwise specified elsewhere, all equipment and material shall be designed to operate satisfactorily with the following minimum requirements with the specified tolerance without any derating.

a.	Voltage rating of equipments	MV	15000V	Three phase ± 10%
b.	Voltage rating of equipments		500V	Three phase ± 10%
	LV		250V	Single phase ± 10%
c.	DC voltages		24V DC	± 10%

		12V DC Others	
d.	Frequency	50 HZ	± 2 HZ

6.0 STANDARDS

The latest standards and codes of reputable organizations shall be applicable for the material and equipment specified herein and for installation work. Such organizations to be British Standard Institution (BSS), International Electro technical Commission (IEC), IEEE and NEC. In case the Specifications laid down herein differ from those given in the standards, then the better specifications shall govern. Wherever applicable, the equipment shall also conform to the requirements of Pakistan Standard Institution (PSI).,Pakistan Telecom Authority.

7.0 MATERIALS & WORKMANSHIP

All materials, equipment, accessories, fixtures and fittings, under the scope of this Contract, shall be brand new and in accordance with the Specifications and the specifications of the British Standards Institute and Pakistan standards institute. Samples and detailed manufacturers shop drawings (including dimensional plans, elevation, sections, line and wiring diagrams, foundation details, component characteristics and data etc.), shall be approved by the Engineer before purchase or fabrication. The Engineer shall witness routine tests at the manufacturer’s work sites and a test certificate shall be provided to him. Three copies of the test certificates at the manufacturer's works shall be supplied. All workmanship shall be first class and undertaken by workman skilled in the particular type of craft.

8.0 DEVIATIONS

The entire design of the Electrical systems of the project has been carried out to fulfill the Users requirements. The design is based on International standards/norms and practices. Special considerations have been made for ease in operation and maintenance of electrical systems of the project. Deviation may be allowed for the works covered under present scope of work, with the approval of Engineer/Client

9.0 EQUIPMENT AND MATERIALS

The equipment/materials of the Electrical systems of the have been designed using the latest editions of International Standards/Codes such as BS, ICE, NFPA, CP as mentioned in article 6.0 above. In these specifications certain types/makes of equipments/ materials have been specified for the purpose of general reference and guidance of the Bidder. However, names of certain manufacturers/suppliers of electrical equipments/materials have been recommended for this project.

The names and addresses of these recommended manufacturers/suppliers are given in the documents. The Contractor is bound to supply and install the required equipments/ materials only from the recommended manufacturers/ suppliers.
In case, if at a later stage in project, the contractor wishes to substitute the specified equipment or materials, he shall furnish complete details of equipment/ substitute to materials.

The equipment/substitute equipments/materials will only be considered by the Engineer if he is satisfied that the equipment/substitute material have technically equivalent/better specifications .In case if the Engineer feels that the equivalent/substitute materials are of less cost compared to the specified materials then the contractor shall give comparative discount in the contract value of the BOQ items.

In case the cost of equivalent/substitute item is more the than the cost of BOQ item then no cost adjustment shall be made in the relevant BOQ item. Once the equivalent/substitute materials are recommended for approval by the Engineer the same shall be forwarded to the Employer/Client for their approval. The equivalent/substitute materials shall only be accepted after the Client's final approval.

All materials and equipments being provided by the Contractor & the Sub-contractor shall be interchangeable to the maximum extent with respect to makes, types, model etc.

10.0 DRAWINGS, AND DATA TO BE FURNISHED BY THE CONTRACTOR

Submittal

The contractor, after the award of work, shall submit for approval of the Engineer all drawings and cuts of equipment, appliances, fixtures and accessories that are to be furnished under the contract. After final approval of a sufficient number of copies as desired shall be furnished for distribution. Manuals, cuts, catalogues and drawings shall be clearly marked to indicate, the items furnished. Cuts of all fixtures, and not a few, shall be submitted.

Approval of Drawings and Data

The Contractor shall provide detailed electrical drawings, wiring diagrams, foundation details, etc., for all electrical and other systems etc., for the Engineer's review and approval.

The manufacturing of electrical equipment shall be started only after the above mentioned drawings and data are approved.

The time required for review and approval shall be considered included in the total time of completion of job.

Three sets of drawings and data for each equipment shall be furnished by the Contractor for the Engineer's approval before commencement of fabrication and manufacturing. The drawings to be supplied by the Contractor shall be as follows:

- Arrangements
- Dimensional Plans, elevations and front view
- Foundation Plan, anchors and configuration
- Incoming and outgoing cable termination positions
- Earthing arrangement
- Electrical Drawings showing:

    - Single-Line diagram
    - Detailed wiring diagram
    - All interconnections
    - Other electrical devices including meters instruments and their wiring diagram.
    - Signal and alarm circuit

Shop Drawings

The locations, routing and installation heights of the equipment etc. Which are given on the drawings, are approximate. These drawings depict only the position of various fixtures and outlets. All the detailed planning for electrical and communication systems including conduit routes etc. shall be carried out, well in advance of the actual execution of work, by the Contractor to the satisfaction of the Engineer. For this purpose the Contractor shall prepare shop drawings and obtain prior approval of the Engineer. Three prints of each shop drawings shall be submitted for obtaining approval. No piece of work shall be allowed to be executed at site without the availability of these approved shop drawings. These shop drawings shall clearly depict the load balancing chart of each distribution board. Time required for the preparation and approval of shop drawings shall be considered to have been included in the total time allowed for the completion of the work.

As-Built Drawings

Clearly annotated "As-Built" electrical drawings and diagrams shall be maintained upto date on site on completion of the Job. One reproducible and three prints of each drawing shall be submitted to the Engineer alongwith a recommended maintenance schedule chart and manuals/operating instructions for equipment supplied. The Contractor shall also provide complete detailed identifications of MV incoming and LV outgoing circuits, in the form of line drawings, for each pad mounted transformer. The line drawings shall be made on 20 SWG sheet metal work. The line drawings shall be clearly identified with permanent colors. The MV and LV. circuits shall being different colors. The sheet metal work shall be of suitable dimensions so as to be fixed on the inside of the door of the LV compartment of the pad mounted transformers. The line drawing shall be fixed with the help of rivets for permanent installation.

11.0 PRODUCT DELIVERY, STORAGE AND HANDLING

All equipment shall be boxed, crated or otherwise enclosed and protected during shipment, handling, storage and after installation until final acceptance of the equipment. Electrical materials shall be delivered in manufacturer's original cartons or containers with seals intact, as applicable. Large multi-component assemblies shall be delivered in sections that facilitate field handling and installation.

Unless designed for outdoor use, all equipment shall be kept dry, off the ground and covered from exposure to weather. Electrical equipment and equipment having anti-friction or sleeve bearings shall be stored in weather tight storage facilities. Heaters in equipment shall be connected and operated until the equipment is placed in operation. The Contractor shall prevent corrosion, contamination or deterioration of stored equipment.

Equipment and materials shall be handled in accordance with manufacturer's recommendations. Large or heavy items shall only be lifted from the designated points. Padded slings and hooks shall be used for lifting to prevent damage.

All equipment shall be protected until final acceptance and all factory surfaces must be protected from impact, abrasion, discolouration and other damage. All damaged equipment must be repaired or replaced before final acceptance.

12.0 MANUFACTURER'S INSTRUCTIONS

The Contractor shall supply to the Engineer Three (3) copies of manufacturer's instruction manuals in properly bound form for installation, testing commissioning, operation and maintenance of the specified equipment including manuals of spare parts and tools of the equipment. One copy of the documents shall be submitted in original. The installation instructions shall be submitted four (4) weeks prior to commencement of installation of each equipment, and operation & maintenance instruction at least two (2) weeks before the time of commissioning. If the contractor fails to provide the documents the Engineer shall withhold issuance of requisite certificates and deduct suitable amount from the payments to the Contractor.

13.0 GUARANTEE

In addition to the Contractor guarantee and liabilities for satisfactory operation of the works, wherever advised by Engineer, the Contractor shall also furnish written guarantee of the manufacturer or supplier with respect to satisfactory performance, of each equipment. Guarantee shall be given for replacement and repair of part or whole of the equipment that may be found defective in material or workmanship. The guarantee shall as a minimum cover the duration of Maintenance Period as defined in the Conditions of Contract. This guarantee shall not relieve the Contractor of his obligations and he will be fully responsible

for the repair or replacement of any defective material in time, so as not to cause any undue delay in carrying out the repairs and/or replacements.

14.0 INSTALLATION INSTRUCTIONS

The Contractor shall furnish all labor, materials, tools and equipment required to install, connect, test and commission all electrical equipment specified herein, whether or not such equipment is furnished by him or by others.

For all equipment to be installed by the Contractor, the Contractor shall supply and install all erection materials such as foundation bolts, washers, nuts, etc. as required and without any additional costs.

The Contractor shall set out the works himself as per Specifications and Drawings and shall properly position the equipment on specified foundation/location. In general, the manufacturer's instructions for installation shall be followed.

Any defect or faulty operation of equipment due to the Contractor not following the manufacturer's instructions shall be corrected and repaired by the Contractor at his own cost as per these specification and to the satisfaction of Engineer.

For any deviation from the working drawings that are deemed necessary by the Contractor due to site conditions, he shall submit the details and obtain the Engineer's approval before starting such works.

15.0 PRESHIPMENT INSPECTION AND TESTING

15.1 General

All equipment and material covered in scope of this contract are subject to pre-shipment inspection & testing at the manufacturer’s factory/works. The Contractor, in coordination with the manufacturers of relevant materials shall arrange for the pre-shipment inspection & testing by the Engineer at the manufacturer’s factory/works. The Contractor shall make all necessary arrangements and cater for all expenses in this regard for the traveling, boarding and lodging of the Engineer plus daily allowance @ Rs. 5000 per day per person within Pakistan (minimum 03 persons) and US $ 200 per day per person outside Pakistan (minimum 03 persons), for the pre-shipment inspection and to witness the tests at the manufacturer’s factory/works.

15.2 Pre-shipment Factory Tests

15.2.1 MV & LV Switchgear, Generators, Transformers, Maintenance-Bypass Switch & Communication Systems Equipment

All type and routine tests on all equipment, materials and switchgear shall be performed at the manufacturer's works in the presence of the Engineer or his Representative. Type tests may be waived off in case test certificates, certified by an approved standard laboratory of international repute, approved by the Engineer, are submitted. But merely producing the type test certificates shall not relieve the Contractor and the manufacturer to carry out the required tests.

The Contractor shall obtain from the manufacturer and submit to the Engineer for approval, the complete details of tests to be performed describing the procedures, test observations and expected results.

The Contractor shall ensure availability of all tools, instruments, test equipments, materials, etc., and all qualified personnel required for the testing, setting and adjustment of all equipments and materials including putting the same into operation.

All tests shall be made with proper regard for the protection of the personnel and equipment and the Contractor shall be responsible for adequate protection of all personnel and equipment during such tests. The cost of any damages or rectification work due to any accident during the tests shall be the sole responsibility of Contractor.

The Contractor shall record all test values of the tests made by him on all equipment. Four (4) copies of all test data and results certified by the Engineer shall be given to the Engineer for record purposes. These shall also include details of testing method, testing equipment, diagrams, etc.

The Contractor shall inform the Engineer about the place, date and time of test, of each equipment at least, two (2) weeks in advance. The witnessing of test by the Engineer or his representative shall not absolve the Contractor from his responsibility for the proper functioning of the equipment, and for furnishing the guarantees referred to in clause 8.0. All test results shall be supplied in quadruplicate.

15.2.2 **Insulation Resistance Test**

Insulation resistance test shall be made on all electrical equipment by using a meggar of 500 volts for circuits upto 250 volts and meggar of 1000 volt for circuits between 250 and 500 volts. The Engineer shall advise the exact testing

voltages. The insulation resistance values of cables, switchgear, etc., shall be as per BSS, IEC, ICEA and Pakistan Electricity Rules.

15.3 Field Tests

15.3.1 General

Upon completion of the installation, the Contractor shall perform field tests on all equipment, materials and systems. All tests shall be conducted in the presence of the Engineer for the purpose of demonstrating equipment and systems compliance with Specifications. The Contractor shall submit for Engineer's approval complete details of tests to be performed describing the procedure test observations and expected results.

The Contractor shall furnish all tools, instruments, test equipment, materials, etc., and all qualified personnel required for the testing, setting and adjustment of all electrical equipment and material including putting the same into operation.

All tests shall be made with proper regard for the protection of the personnel and equipment and the Contractor shall be responsible for adequate protection of all personnel and equipment during such tests. The cost of any damages or rectification work due to any accident during the tests shall be the sole responsibility of Contractor.

The Contractor shall record all test values of the tests made by him on all equipment. Four (4) copies of all test data and results certified by the Engineer shall be given to the Engineer for record purposes. These shall also include details of testing method, testing equipment, diagrams, etc.

The witnessing of any tests by the Engineer does not relieve the Contractor of his guarantees for materials, equipment and workmanship, or as any other obligations of contract.

15.3.2 Insulation Resistance Test

Before making connections at the ends of each cable run or joint between cables, the insulation resistance test of each cable section shall be made. Each conductor of a multicore cable shall be tested individually with each of the other conductor of the group and also with earth. If insulation resistance test readings are found to be less than the specified minimum in any conductor, the entire cable shall be replaced and tests repeated on new cable. If cable joint is

provided, then each cable section shall be tested, and joint made only after the tests have been made satisfactorily. Finally the completed cable length including the joints shall be tested.

All switchgear shall be given an insulation resistance test after installation, but before any wiring is connected. Insulation tests shall be made between open contacts of circuit breakers, switches and between each phase and earth.

If the insulation resistance of the circuit under test is less than the specified value, the cause of the low reading shall be determined and removed. Corrective measures shall include dry out procedure by means of heaters, if equipment is found to contain moisture. Where corrective measures are carried out, the insulation resistance readings shall be taken after the correction has been made and repeated twice at 12 hours interval. The maximum range for each reading in the three successive tests shall not exceed 20% of the average value. After all tests have been made, the equipment shall be reconnected as required.

15.3.3 **Earth Resistance Test**

The Contractor shall make Earth resistance tests on the earthing system, separating and reconnecting each earth connection.

If it is indicated that soil treatment or other corrective measures are required to lower the ground resistance values, the Engineer will determine the extent of such corrective measures.

The electrical resistance of the ECC together with the resistance of the earthing leads measured from the connection with earth electrode to any other position in the complete installation shall not exceed one ohm.

Earth resistance test shall be performed as per Electrical Inspector's requirements. Where more than one earth electrodes are installed, the earth resistance test of each electrode shall be measured.

The complete lightning protection system shall be tested for continuity and earth resistance. The combined earth resistance at any point in the lightning protection system shall not exceed ten (10) ohms.

15.4 Completed Tests

After any equipment has been tested, checked for operation, etc., and is accepted by the Engineer, the Contractor shall be responsible for the proper protection of that equipment so that subsequent testing of other equipment do not cause any damage to the already tested equipment.

16.0 ASSOCIATED CIVIL WORKS

The cost of all civil works which are associated with any BOQ item are deemed to have been included in the respective items of Bill of Quantities unless specifically stated otherwise. The civil works shall include excavation, backfilling of earth, complication of the earth, foundation pads, grouting, chiseling, making openings, etc. Such works will also include repair of any damage to civil works caused by the Contractor during electrical installation.

17.0 EXPENSES TO BE BORNE BY THE CONTRACTOR

All expenses regarding travelling, boarding, lodging and witnessing of tests by the Engineer or his representative and/or the owner or his representative including costs for carrying out the required tests shall be borne by the Contractor and are deemed to have been included in the bid.

18.0 TEST CERTIFICATES TO BE FURNISHED BY THE CONTRACTOR

After all field tests have been carried at site, the Contractor shall furnish test certificates for the following equipments and materials as supplied and installed by the contractor;

- Lighting fixtures
- MV & LV Switch Boards & Distribution Boards
- MV & LV Power cables
- Diesel Generator Sets
- Dry Type Transformer (11/0.400kV)
- Earthing system
- Fire Detection & Alarm system

19.0 PAYMENT

No separate payment shall be made for work involved within the scope of this section, unless specifically mentioned in the respective items of Bill of Quantities.

5. ENERGY MONITERING SYSTEM

Scope of Works

The work under this section consists of supplying all materials and accessories for a complete Energy Monitoring System as specified herein and/or given in the Bill of Quantities.

The description of the energy monitoring system components, including meters, sensors, and communication modules, is provided in the Bill of Quantities and marked on the relevant Single Line Diagrams. All other relevant materials are described in this section. The determination of quality is based on required certifications and compliance with applicable international standards.

The Energy Monitoring System (EMS) shall provide real-time monitoring, analysis, and reporting of electrical energy consumption.

Smart energy meters shall be installed at main incoming supply and sub-distribution panels to measure:

- Voltage (V), Current (A), Power (kW, kVA, kVAR), Power Factor (PF), Frequency (Hz)
- Energy Consumption (kWh, kVAh, kVARh)
- Harmonic Distortion (THD-V, THD-I)
- Demand and Load Profile Recording

Meters should support MODBUS RTU/TCP, BACnet, OPC or MQTT for communication with EMS/BMS.

1.0 Applicable Standard / Codes

The latest editions of the following standards/codes shall be applicable to the material specified within the scope of this section.

IEC 62974-1	For monitoring and measuring systems used for energy efficiency
ISO 50001	For energy management systems (EnMS) and efficiency improvement
IEC 61000-4-30	For power quality measurement methods
IEC 60364-8-1	For low-voltage electrical installations and energy efficiency
EN 17267	For energy measurement and monitoring in buildings
ASHRAE 135 (BACnet)	For building automation and control networking in energy monitoring
IEEE 519	For harmonics and power quality monitoring in electrical systems

IEC 61557-12 For power metering and monitoring devices (PMD)

1.1 Material

Graphical Based Digital Analyzer:

The required Digital Analyzer should have the following specifications:

Approved Manufacturer	ABB / Schneider Electric / Siemens
Input Voltage (Un)	Up to 600 VAC
Meter Type	Directly connected / CT-operated
No. of Phases	3ph + N
Network Frequency	50 Hz
Power Consumption	10 VA Max
Rated Operating Voltage	220/400 V
Starting Current	Less than 10 mA

Active Energy Class	Class 0.2S (as per IEC 62053-22)
Reactive Energy Class	Class 2 (as per IEC 62053-23)
Power Accuracy	±0.2%
Harmonics Measurement	Up to 50th harmonic
Data Logging Interval	Configurable (1 min to 60 min)
Degree of Protection	IP54 (Casing)
Operating Temperature	-10°C to 55°C
Relative Humidity	0% to 95% non-condensing
Anti-Tamper Function	Built-in
Communication Type	RS-232, RS-485 (Modbus RTU), Ethernet (Modbus TCP/IP)

2.0 MEASUREMENT AND PAYMENT

General

The Contractor's bid amount against each schedule of price item as given below shall include supply, installation, testing, commissioning and completion of all work

specified herein and/or as shown on the Drawing related to the item.

2.1 Graphical Based Digital Analyzer

2.1.1 Measurement

Measurement shall be made as complete unit for including all related equipment, alongwith all accessories acceptably supplied and installed by the Contractor as a complete unit.

2.1.2 Payment

Payment shall be made for the complete unit measured, as provided alone, at the contract unit price and shall constitute full compensation for supplying, installing, testing and commissioning along with all accessories.

2.2 Gateway/Master or data logger

2.2.1 Measurement

Measurement shall be made for the number of unit acceptably supplied and installed by the Contractor as complete unit.

2.2.2 Payment

Payment shall be made for the number of units measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing, testing and commissioning of complete unit including all required accessories.

2.3 Software for online energy analysis

2.3.1 Measurement

Measurement shall be made for the number of unit acceptably supplied and installed by the Contractor as complete unit.

2.3.2 Payment

Payment shall be made for the number of unit measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing, testing and commissioning of complete unit including all required accessories.

2.4 Hardware

2.4.1 Measurement

Measurement shall be made for the total number of units acceptably supplied and installed by the Contractor as complete unit.

2.4.2 Payment

Payment shall be made for the total number of unit measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing, testing and commissioning of the complete unit including all required accessories.

2.5 Cable and Wires

2.5.1 Measurement

Measurement shall be made of the total number of running feet for each type and size of cable acceptably supplied and installed by the Contractor.

2.5.2 Payment

Payment shall be made for the total number of running feet of each type and size of cable at the Contract unit price. The payment shall constitute full compensation for supply, installing, testing and commissioning of the required cables including all accessories.

SECTION – 8151

6. LOW VOLTAGE DG SET & AUTO MAINS FAILURE/ STARTUP (AMF/ATS) PANEL AND SYNCRONIZING PANEL

1.0 DESCRIPTION

The work under this section consists of supplying, installation, testing & commissioning of all material & accessories with one (01) year of warranty from the date of installation after successful testing & commissioning for the complete Diesel Generators of Prime rating (at 50^0C), duly to be established by the manufacturers derating curves, losses and efficiencies of the engine, alternator and DG Set including but not limited to power cables, Automatic Mains Transfer Switch/Automatic Main Failure Switch Panel, LV Switchgear, fuel tanks (including day and underground storage tanks), control panels, canopy, all accessories as specified here-in, and given in the Schedule of Prices.

The Diesel Generator (Prime rating) set shall be a standard design in accordance with the latest applicable International Standards of a reputed manufacturer, who shall have similar units in operations for similar applications and field conditions.

The DG set shall be of prime rated duty and suitable for indoor/ outdoor (as applicable) installation. It shall be capable for unbalanced loads up to 30% of actual load and for continuous part load operation. The set shall be capable of starting and operating at the rated output as per the climatic conditions (typical range given in the following table) and at an altitude of the site of installation (given level of the site of installation in meters above mean sea level). The power rating shown in the relevant section of Schedule of prices (bill of quantities) is the power rating required to be delivered to load by the diesel generator set after applying all de-rating factors relevant to the site.

The table below shows the ambient temperatures (see definition (1) and the relative humidity rates to which the equipment can be submitted according to the category they belong; the later may be stated by the particular specifications.

Climatic Conditions

Category	**I**		**II**		**III**	
Rated operating range (2)	T1: +15°C	T2: +30°C	T1: -5°C	T2: +45°C	T1: -25°C	T2: +55°C
Maximum operating limits (3)	T3: +5°C	T4: +40°C	T3: -10°C	T4: +60°C	T1: -15°C	T2: +60°C
Maximum relative humidity	75% at +23°C		80% at +23°C		100% at +45°C	
Operating location example	Air conditioned room		Non air conditioned room		Outdoor	

1. Ambient temperature (IEC 60441-02-06)

   Temperature determined within specified conditions of the air which surrounds the whole equipment.

2. Rated operating range:

Range of values at which equipment performs within specifications.

3. Maximum operating limits:

   Range of values at which equipment can still work without deterioration or degradation of its operating qualities.

The DG set ratings must be substantiated with manufacturer's standard published data. The Diesel Generator set after reducing the power absorbed by the auxiliaries, shall deliver rated power output under the site conditions. All auxiliaries, accessories and connections between systems along with all necessary cables, fittings, hardware, etc., for complete installation of Diesel engine, Generator, control panel, including fuel & oil storage, exhaust system, etc., shall be furnished by the manufacturer.

The engine shall be directly coupled to the generator, and shall have a rated speed of 1500 rpm. The set shall be capable of sustaining without damage, 25% over speed under any abnormal operating condition.

The engine-generator set shall be mounted on suitable rigid steel base frame with vibration isolators. Heavy duty lifting eyes and/or jacking screws shall be provided on the skid. The foundation bolts and all other material/hardware for complete installation of the set, as required, shall be furnished with the set. Any excessive torsional vibration shall be avoided for both engine and alternator. The set shall be suitable for full load starting. When the generator is operating at no-load, the application of full load current, taking into account the surge due to starting of equipment, should be possible with maximum transient voltage drop of 15% of the rated voltage. The time taken to restore the generator voltage to 97% of rated value should not exceed 1.5 seconds. The set shall be capable for starting and accepting full load within 15 seconds after receipt of starting signal. The Manufacturer shall submit the equipment layout and other installation details along with the bid.

The details and technical data concerning Diesel Generator set shall be submitted with bid. Where required the documents from the manufacturer shall be furnished in support of the information furnished.

The alternator and engine shall be as follows:

Alternator Make/Brand:

Siemens, Newage/Stamford/Cummins, Lorrey-Sommer, Cater Pillar/ Olympian or approved equivalent.

Diesel Engine Make/Brand:

Volvo, Perkins, Cummins, Mitsubishi, John Deere, Cater Pillar or approved equivalent.

Operating Console:

DeepSea, Power Wizard, APM, Intli Compact, DataCom or equivalent

Warranty

The DG Sets shall be supplied from the manufacturers/authorized agents or firms having strong local presence duly authorized by the manufacturer for sales, services and after sales back up support system and facilities along with suitable full time operation and maintenance experience with Pakistan.

The manufacturer/ authorized agent shall also have adequate maintenance facilities in the vicinity of Project with mechanically qualified and experienced personnel trained for operation and on-site maintenance of the equipment & materials offered by the Manufacturer in his bid.

To verify the capability of after sales service backup support locally in Pakistan, following shall be furnished by the contractor with duly verifiable documentary evidence from the supplier:

1) Complete company profile of the supplier, in house testing facilities, testing procedures, testing equipment/tools details.
2) Valid Nomination letter/dealership certificate from the DG set manufacturer for the supplier.
3) Successfully completed project reference list of the DG sets clearly indicating the project names, rating of the DG sets & quantity supplied alongwith the satisfactory performance certificates from the customers/authorities.
4) List of projects for which the supplier already providing O&M services alongwith customer satisfactory operational certificates for O&M.

The projects for which certificates shall be provided must be comparable in terms of quantities of the DG sets maintained.

The DG sets supplier /authorized agent/assembler shall be responsible for providing one (01) year of standard warranty and during the warranty period the supplier /authorized agent/assembler of the DG sets shall be fully responsible for replacements of any/all defective components/parts against manufacturing defects with the genuine products/components through the manufacturer/authorized agents under the supervision of the contractor.

The involvement of the manufacturer/authorized agent for maintenance/replacement of components is considered important because the warranty of the manufacturer becomes void if genuine product/manufacturer recommended methodology/components installation is not followed.

Undertaking in this regard shall be submitted by the contractor as well as manufacturer/authorized agent/assembler to the Client.

2.0 APPLICABLE STANDARDS/CODES

The Diesel Engine and Generator set shall conform to the following standards as applicable.

ISO3046 - (Reciprocating internal combustion engines)

BS 4999 - General Requirements for Rotating Electrical Machines.

DIN EN 12285-2; 2005 - Horizontal Steel Tanks for the Storage above Ground of Petroleum Products in Liquid Form.

For other equipment and materials related to the Diesel Generator set, the Manufacturer shall follow relevant international standards.

3.0 MATERIAL REQUIREMENTS

3.1 Diesel Engine

3.1.1 General

The Diesel Engine shall be four strokes, compression ignition, suitable for Emergency supply duty. Starting shall be through motor operated electric starter. The engine shall be equipped with an alternator type automatic charging system to charge the batteries during running of engine. The engine shall be provided with required auxiliaries, guarantees of fuel consumption, acceptance tests, torsional vibration characteristics.

3.1.2 Air Intake

Air intake shall be through turbo charger and equipped with dry type filter. Suitable attenuators shall be installed to reduce noise at the air inlet. The filter assembly shall be constructed of non-corrosive materials.

3.1.3 Engine Cooling

Engine shall have a forced air draft, water cooled radiator supplied with a core guard. Cooling system shall have an engine driven centrifugal pump for cooling water circulation. Cooling shall be thermostatically controlled. An engine shut down timer shall be provided to keep the engine running on no-load after any operation of set, so that the engine is sufficiently cooled to start again instantly, if required, without rise in temperature above safe limits. The radiator shall be designed to cool the engine at specified output in ambient temperature upto maximum value. Radiator flexible ducting, flange and all necessary ductwork, flexible connections, fittings and supports shall be supplied to extend from the radiator to the exhausts louvers so that hot air from the radiator escapes freely to the outside of the building.

3.1.4 Engine Lubrication

A gear type positive pressure lubrication pump shall be provided with efficient filtration arrangement for the lubrication system. A 230Volt AC mains-operated heater with thermostat shall be provided in the crankcase. The heater shall be designed for automatic switching to ensure that temperature of oil is maintained for proper operation of the engine.

3.1.5 **Speed Governor**

The speed governor shall be electronic or digital complying with the requirements BS ISO 3046 or latest applicable international standard. Governor shall regulate engine speed so as to maintain the generator frequency within ±2% of the rated frequency. Stable engine speed shall be attained within 15 seconds after the engine has been started. Stable engine speed shall be restored within 10 seconds of any sudden change in load, from no load to full load. During this change of load or surge, the speed shall not vary by more than ±5% of the rated speed. Means shall be provided on the engine to shut down the engine automatically in the event that the engine speed exceeds the "shutdown" speed.

3.1.6 **Fuel System**

Engine shall operate on Commercial High-Speed Diesel oil. A fuel oil strainer/filter shall be provided in the fuel line along with a water separator. Fuel system for Diesel engine shall not require any priming. The fuel system shall comprise;

- Fuel storage tank(s)
- Day Tanks
- Fuel transfer pumps
- Piping

The fuel day tank shall have capacity to store fuel oil for twenty four (24) hours continuous operation of the set at the rated output. The tank shall have level switch for monitoring low fuel level in the tank. The low-level switch shall provide an annunciation and prevent starting of set and to stop the set when the fuel in day tank is at this level. The tank shall be provided with overflow, vent, supply and discharge valves, inspection cover, drain valve and glass sight gauge.

The fuel day tank shall be designed, fabricated and finished in accordance with the requirements of DIN EN 12285-2;2005 - Horizontal Steel Tanks for the Above Ground Storage of Petroleum Products in Liquid Form. The fuel day tank shall be incorporated in the steel base frame of the DG set. The structural steelwork shall be protected from corrosion.

The fuel piping to be furnished shall include fuel supply pipe from tank to the set, over flow pipe from the set to the tank, level indicator, fuel cap with breather, drain pipe from the tank.

Drain Line: The day tank drain tank shall be accessible and equipped with a shut off valve. Self supporting day tank shall be arranged to allow drainage into a 305mm high bucket. The local

fuel fill port on the day tank shall be provided with a screw on cap.

3.1.8 Radiator Exhaust Duct

The radiator exhaust duct shall provided for exhaust of hot air through DG set radiator. The radiator exhaust shall be designed and routed in such a way so as to give minimum resistance to airflow.

3.1.9 Exhaust System

Exhaust system shall be equipped with a **HEAVY DUTY RESIDENTIAL** type silencer complete with muffler, exhaust manifold, flexible connector, exhaust elbow, exhaust pipe, rain cap, and associated fittings. This exhaust line shall be adequately covered with insulation material over its entire length i.e. from the engine to the termination point at rain cap. All supports for exhaust system shall be furnished. Hangs and supports shall be provided for the silencer such that essentially no load is transmitted to the engine.

3.1.10 Battery

Heavy-duty maintenance free lead acid batteries shall be provided with the set and mounted on the skid. The fully charged batteries shall be furnished with the set and connected with the help of heavy duty interconnecting cables.

The batteries shall be of adequate ampere-hour rating/capacity to satisfy the following requirements:-

a. Crank the engine at firing speed for at least 15 seconds.
b. If the engine does not start on the first attempt, crank the engine two more times for the above duration at an interval of 30 seconds between each cranking operation.

3.2 Alternator

3.2.1 General

The alternator shall be synchronous. The alternator shall be capable of carrying, continuously 10% over load of rated output with the field set for normal rated load excitation for 1 hour in every 12 hours operation.

The alternator shall be rated as follows:

Capacity	:	As stated in BoQ
Voltage	:	400/230 V

Phases	:	3Phase, 4 wire, grounded neutral
Frequency	:	50 Hz
Power Factor	:	0.8 lagging

3.2.2 **Excitation**

Excitation shall be from brushless rotating diodes mounted on the main shaft for 3-phase full wave rectification.

3.2.3 **Windings**

Alternator windings shall have Class H insulation and shall be impregnated for tropical use. The temperature rise of winding under normal operating conditions and at rated load shall not exceed the limits specified for Class-B insulation. Anti-condensate heaters shall be provided for windings. The heaters shall be thermostatically controlled for switching **ON** after the set has stopped. The thermostat range shall be adjustable and set to prevent overheating of windings. For protection of windings from damage due to overheating, thermistors shall be embedded to stop the set in case the temperature of winding rises above the safe value.

3.2.4 **Deviation Factor**

The deviation factor of the open-circuit line to line terminal voltage shall not exceed 0.10.

3.2.5 **Voltage Regulation**

Voltage regulator shall be solid state with provision for manual setting. Regulator shall be so designed to protect the exciter when the set is running at reduced speed during starting or idling of the prime mover. Voltage regulation shall be $\pm$ 2.5% from no-load to full load. Transient voltage drop shall be less than 15% at full load and 0.8 power factor. Time required to restore to steady state conditions after transient voltage fluctuation shall not exceed 10sec.

3.2.6 **Short Circuit Capability**

Generator shall be capable of withstanding without injury, a 30 seconds three phase short circuit at its terminals when operating at rated output and power factor with fixed excitation.

3.2.7 **Temperature Rise**

Alternator temperature rises at continuous rating in an ambient of 52 degree C shall not exceed 70 degree C by resistance measurement on the field. The exciter temperature rise shall not

exceed 52 degree C by resistance measurement on field or armature when the main generator is on continuous rating.

3.2.8 **Vibration and Balance**

The vibration level of the alternator when coupled to the engine shall not exceed the ISO Specifications or equivalent.

3.2.9 **Bearings**

The bearings shall preferably be grease lubricated and anti-friction type and shall be selected to provide for long trouble free service.

3.3 **Indication/Metering Panels**

3.3.1 **General**

The indication/metering panel shall be designed for front access, completely assembled, wired and tested. The control panels shall conform to the constructional requirements as per international standards and norms.

The panel shall incorporate protection and control equipment, measuring instruments, control and instrument transformers, voltage regulator, governor controls, battery charger, indicating lamps, etc. Engraved nameplates of stainless steel shall be provided on all panels for clearly identifying panels and devices mounted inside of panels. Standard nameplate with black lettering shall be provided.

Cables and capillary tubing shall be tagged with a neoprene disc or approved equivalent, stamped with the cable number or tube function for easy identification.

3.3.2 **Moulded Case Circuit Breakers**

The Four pole moulded circuit breaker shall be provided with the set. The circuit breaker shall have the Thermal over current and short circuit releases as below:

Ith = 60 to 100% of Current rating
Isc = 50 kA (min)

The circuit breaker shall be mounted in a vibration isolated sheet steel box with adequate access for incoming and out going cables.

3.3.3 Magnetic Contactors

The contactors shall be four pole, 400 V AC duty cycle-3. The main contacts shall be silver tipped, but type with double break per pole. Each contactor shall be provided with 230V AC single phase operating coil, and minimum two normally open and two normally closed auxiliary contacts wired upto terminals. But if more number of working auxiliary contacts are required then, these shall be provided according to the system requirements.

3.3.4 Battery Charger

Multi stage intelligent (Digital Microprocessor based with a communication port RS 485) high efficiency battery charger with automatic charging stage selection, capable of charging of a wide range of batteries, when engine is not running. The charger shall be fully capable to recharge a completely discharge battery within four hours at boost/maximum charge. The charger shall be of constant voltage and constant current with maximum current been drawn during charge recovery phase. The charger should automatically return to float/trickle mode when charging is complete.

The charger should have following safety features:

- Input under voltage protection
- Input over voltage protection
- Battery charge over voltage protection
- Battery output over current protection
- Short Circuit protection
- Battery temperature compensation with over temperature protection
- Reverse Polarity protection
- Automatic power derating at high ambient temperatures

Applicable Standards for Battery Charger:

- BS EN 61000 (Electromagnetic compatibility)
- BS EN 60950 (Electrical safety)
- BS EN 60068 (Temperature, Vibration, Humidity and Shock)
- BS EN 60529 (degree of Protection)

3.3.5 Instruments and Controls

i. Ammeter (measuring as required)
ii. Ammeter Phase selector switch
iii. Voltmeter (0-500 volt AC)
iv. Voltmeter phase selector switch

v. Frequency meter
vi. Start / stop key switch
vii. Battery condition voltmeter
viii. DC Voltmeter for batteries
viii. Tachometer for Engine speed in Revolutions Per Minute (RPM)
ix. Lube oil pressure in PSI
x Lube oil temperature in Degrees Celsius
xi. Engine water temperature in Degrees Celsius
xii. Engine operation/ running time in hours

3.5 Safety Devices

3.5.1 Following safety devices shall be provided. The audible alarm shall operate on any fault condition and shall be resetable manually and automatically through a timer after 15 minutes whichever is earlier:

A = Alarm **SD** = Shutdown **TD** = Adjustable Time Delay

i)	Engine Over speed	**A**	**SD**	
ii)	Low lube oil pressure	**A**	**SD**	
iii)	High water temperature	**A**	**SD**	
iv)	Over voltage	**A**	**SD**	**TD** (0-30 Sec.)
v)	Under voltage	**A**		
vi)	Short circuit and tripping of circuit breaker.	**A**	**SD**	**TD** (0-1 min.)
vii)	Low level in fuel storage tank		**A**	**SD** **TD** (0-5 min.)
viii)	Winding temperature high	**A**	**SD**	**TD** (0-2 min.)
ix)	Over crank	**A**	**SD** (After THREE Successive crankings)	
x)	Low crankcase oil level	**A**		
xi)	High crankcase oil level	**A**		
xii)	Charging alternator failure	**A**		
xiii)	Charger failure	**A**		

For all shut down conditions, the set shall lockout and it shall not be possible to re-start it unless manually reset after the cause of fault has been removed.

3.5.2 **Generator Electrical Protections:**

Following electrical protections shall be provided in the generator:

1. High AC voltage shutdown	12. Reverse Power shutdown
2. Low AC voltage shutdown	13. Reverse VAR shutdown
3. Over frequency shutdown:	14. Under voltage shutdown:
4. Under frequency shutdown/warning	15. Over voltage shutdown:
5. Over Current warning/Shutdown:	16. Low and high battery voltage warning
6. Loss of sensing voltage shutdown	17. Weak battery warning
7. Field overload shutdown	18. Fail to start (over crank) shutdown
8. Over load (kW) warning	19. Reverse power protection
9. Short circuit protection:	20. Smart starting system
10. Digital Voltage Regulator	21. Battery monitoring system
11. PMG Excitation	

3.6 **Auto-Mains Failure/Transfer (AMF/ATS) Panel**

The AMF/ATS shall be floor mounted front access, completely assembled, wired and tested. The control panel shall conform to the constructional requirements as stated in these specifications for LV switch boards.

The AMF/ATS shall incorporate automatic changeover system, which will be designed for the following functions:

a) To start the set immediately when the main supply fails

b) To start the set within the 0 to 1 minutes (adjustable) whenever the main supply voltage drops to 360 volts or rise to 440 volts. The setting voltages shall be adjusted within -5 % and + 5% respectively for the lower & upper ranges.

c) To transfer the load from Generator to main supply whenever the main system voltage returns between 90% to 110% of its rated value and persists for at least 3 minutes.

d) To make two successive attempts, in case the set fails to start in the first and second attempt.

e) The system shall provide for immediate transfer of load to the generator, after the rated speed and voltage have been

achieved. The Generator should start immediately when the main supply fails

f) The system shall be self resetting after each cycle of operation. To start the set immediately when the main supply fails

g) Two normally open potentially free contacts shall be provided which shall close when the set is started with the operation mode selector switch in auto or manual position. The contacts shall be wired upto the terminals block in control panel.

h) A four position selector switch shall be provided for selecting the operation mode i.e. Automatic-Manual-Test-stop/ Maintenance mode to facilitate the following operation:-

i) **Automatic**
As described in a to d.

ii) **Manual**

Manual starting of the set and load transfer from normal to standby and vice versa.

iii) **Test**

Testing the changeover operation when so desired and also for starting and running the set without interrupting the normal operation. In case of failure of main supply, the set shall automatically revert to automatic mode of operation.

iv) **Stop/Maintenance**

Provision shall be made to isolate the system for trouble shooting and maintenance without interruption of mains power supply. The set shall not be capable of starting in this condition.

3.7 Terminal Blocks and Terminals

Terminal blocks for control wiring shall be General Electric Type Eb stud terminal blocks or approved equivalent. Terminal studs and wires shall be numbered or otherwise marked in accordance with the applicable schematic and wiring diagrams.

Terminal blocks shall be arranged with sufficient room for each connection of incoming cables. Parallel rows of terminal blocks shall be spaced at least 150mm (6") apart.

Blocks shall be mounted in vertical columns along the sides of cubicles or on vertical panels specially provided for terminal blocks. 20% spare

blocks distributed over the columns of terminal blocks shall be provided.

Terminals shall be suitable for screw terminals and shall be sized according to the wire being terminated.

Provisions shall be made to terminate and ground the overall copper shields of all incoming cables by a suitable method approved by the Engineer.

3.8 Component Wiring

All internal wiring shall be in accordance with IEC or VDE Standards with annealed copper conductor, thermo-plastic insulated with an overall flame- retardant braid. Wire sizes for control wiring in no case shall be smaller than 2.5 mm2. The wire ends shall be permanently fitted with compression type connectors before attaching to terminal studs.

Wiring between terminals of various devices shall be point to point. All internal wiring shall be neatly trunked in wiring troughs bound and anchored.

All groups of bundled conductors to hinged doors and panels shall use extra-flexible wire arranged so that a twisting rather than a bending motion is imparted to the moving conductor bundle. Each bundle shall be anchored to the fixed member at the opposite end of the hinge axis to the anchoring point on the moving member so that the moving bundle length is the maximum available without loops.

All wires shall be identified at both ends according to the schematic diagram.

3.9 Provision of Integration with IBMS

DG set shall have the provision to integrate with the Integrated Building Management System (IBMS) for local and remote monitoring.

4.0 SPECIFICATIONS OF FUEL TANK, WEATHER PROOF, SOUND ATTENUATED CANOPY AND FOUNDATION PAD

4.1 Fuel Tank

Supply & Installation of backup fuel storage tank, complete with filling cap, vent & suction pipe, minimum 5mm thick, MS sheet and inspection man hole complete in all respect.

4.2 Weather Proof and Sound Attenuated Canopy

Sound and weather proof canopy suitable for the Diesel Generating sets. The canopy shall attenuate the sound level to below 85dB at a distance of 1 meter or less than 75dB at a distance of 3 meters from it. Textured insulation materials, Comprising of fire retardant resin, organic glass/rock fiber to ensure uniform long lasting absorption of sound. The canopy shall be constructed with weather proof corrosion resistant material and shall be modular in design. All sheet components pre-treated with cold fast prior to powder coating. All gas kits/joints be of Edpm (**ethylene propylene diene monomer** (M-class) rubber). The canopy shall be suitable for tropical climates.

a) The enclosure shall allow easy access to the engine, alternator, and radiator filler cap, lube oil filling, filter replacement and control cubicle for easy maintenance purposes.

b) Hinged and lockable doors all around canopy for easy access to D.G. set for routine maintenance and major over hauling.

c) At least 1 foot clearance between the DG Set and Canopy shall be maintained from sites/directions.

d) The enclosure shall be designed to be water and weather- proof.

e) The intake area for air must be 1.8 times the size of radiator.

f) The enclosure base frame should be designed with supports for easy transferred using forklift and crane.

g) Canopy shall be capable of anti-corrosion to withstand high humidity.

h) Proper grouting of both generator and canopy.

i) The thickness of sheet for canopy body must be 4mm (minimum) whereas thickness of and door sheet 2mm (minimum).

j) Glass wool will be of pure fiber.

k) The canvas is to be place between radiator and the canopy that can be easily removed during troubleshooting.

l) GENSET control panel should be visible from outside the canopy by means of plan glass.

m) 4 Nos. Canopy lifting eyes arrangement from top of canopy.

n) Sufficient air intake through Acoustic Louvers from both side & control panel side.

o) Duly painted with good quality water proof and weather proof paint. Painted with 2 coats of zinc oxide primer and finishing with 2 coats of Syntactic Enamel (Burger/ICI) paint.

4.3 Foundation Pad for DG Set

a) Fabrication of RCC Foundation suitable for genset operating weight complete in all respects, foundation to be made according to generator size and should have all required sleeves for piping, conduiting etc. as per specifications.

b) The pad should be at least 12 inches (300mm) height from and extend at least 6 inches (150 mm) beyond the skid on all sides.

c) The weigh (W) of the foundation should be at least 2 times (and up to 5-10 times) the weight of the set itself to resist dynamic loading. (The weight of fuel in a sub-base fuel tank should not be considered to be contributing to the weight required of a vibration isolating foundation even through the isolators are between the tank and the generator set).

d) The foundation should extend at least 6 inches (150mm) beyond the skid on all sides. This determines the length (I) and width (w) of the foundation.

e) The foundation should be reinforced concrete with a 28-days compressive strength of at least 3000 psi

4.4 Tests:

4.4.1 General

The set furnished by the Contractor under this Contract shall be subject to tests in the shop and at site in the presence of the Engineer for conformity to requirements of the Specifications.

4.4.2 Diesel Engine

All mechanical parts shall be run under simulated operating conditions at the Manufacturer's works.

All tests shall be conducted in accordance with the appropriate codes for testing. The tests to be carried out shall include, but not be limited to, the following:

i) Dynamic balancing together with over speed tests of the generator exciter and rectifiers.

ii) Bench testing of all accessories.

iii) Zero load operation of the diesel engine assemblies to test the following:

- Vibration.

- Lubricating system.
- Fuel system.
- Governor system.
- Temperature control system.
- Over speed trip.
- Individual accessories.

The diesel engine and AC generator shall be test-run continuously for 24 hours to ensure smooth running and satisfactory operation of the machines and accessories. The above tests will be witnessed by the Engineer.
The contractor shall state in his proposal the performance and reliability tests to be carried out in the Works.

Tests on the unit shall not be less than the minimum requirements of ISO standard Practices for equipment.

4.5 Generator

4.5.1 General

The set furnished by the Contractor under this Contract shall be subject to tests in the shop and at site in the presence of the Engineer for conformity to requirements of the Specifications.

4.5.2 Routine Tests

Routine tests on the generator shall be performed at the manufacturing works/workshop of the DG Set manufacturer/Supplier. Routine tests shall include:

a) Resistance of armature and field windings
b) Polarity of field coils
c) Check of mechanical balance
d) Check of no-load field current or exciter field current
e) Voltage balance
f) Phase sequence
g) No-load saturation curve
h) Insulation and high potential tests
i) Over speed test at 125% speed for 1 minute
j) Load Tests (24 hours)

1. Continuous thirty minutes heat run at 25 percent load rating
2. Continuous three hour heat run at 50 percent load rating
3. Continuous eight hour heat run at 75 percent load

rating

4. Continuous twelve hour heat run at 100 percent load rating
5. Continuous thirty minutes heat run at 110 percent load rating

Fuel, water and electric power required for "Performance Tests" shall be provided by the Contractor

Where the generator is not completely assembled in the factory, tests (d) to (i) above inclusive may be carried out with the generator coupled to Engine Test (a) to (d) shall also apply to the exciter.

4.5.3 Type Tests

The generator shall have the following tests performed, if required:

a) Short circuit saturation curve.
b) Temperature test.
c) Segregated losses.
d) Voltage deviation factor.
e) Three phase line to line short circuit test at any convenient voltage in the 0.4 to 0.5 p.u. volts.

4.5.4 Characteristics Test Curves

Following completion of type tests, Manufacturer shall provide characteristics curves of the brushless excitation system. These curves shall show:

a) Exciter field amps and volts versus generator line current at 0.80 Pf. and maximum and minimum temperature rises.

b) Exciter field amps and volts versus generator line current at 1.0 Pf and maximum and minimum temperature rises.

c) As for (a) above, but with one diode failed.

The above six curves shall be plotted from no-load to maximum rated load at rated generator voltage. Following approval of curves by the Engineer, they shall be incorporated by the Manufacturer into the Emergency Diesel Generating Set Maintenance Manual.

4.5.5 Performance Tests

At the conclusion of installation of the Emergency Diesel Generating Set at site, commissioning tests shall be carried out by the Contractor/Manufacturer to demonstrate the satisfactory operation of the equipment and to verify the guaranteed performance figures of the diesel unit. The tests shall comprises:

1. Preliminary tests on individual components.

2. Continuous one-hour heat run at 50 percent load rating in parallel with the system.

3. Continuous one-hour heat run at 75 percent load rating in parallel with the system.

4. Continuous four-hour heat run at 100 percent load rating in parallel with the system.

5. Part load heat runs to demonstrate satisfactory operation and establish fuel consumption at the respective loads.
6. The tests shall also include:
    a) Performance of Governing characteristics and protective systems.
    b) Starting characteristics of the units. The units shall start at least five (5) times in six (6) consecutive starting attempts.

    c) Starting power requirements to demonstrate the ability of the machine to start the specified number of times without need to recharge the batteries.

The instrumentation supplied as standard with the equipment will be used during the commissioning tests for measurement of voltage, frequency, temperatures, pressures, etc. normally recorded during commercial operation. Additional instruments required for the measurement of electrical output, fuel flow, vibrations, etc. shall, at no extra charge, be provided by the Contractor.

Tests to be carried out manufacturer's work and at the site shall be to the satisfaction of the Engineer. Seven copies of test certificates shall be forwarded to the Engineer immediately following each test. The site test report shall include a list of final settings and adjustments carried out during commissioning.

If the tests show that the set does not reasonably comply with Bid, the Contractor/Manufacturer shall, at his own expense, make all necessary corrections to the unit. Additional tests shall then be made to demonstrate the effectiveness of these corrections. Until the necessary corrections have been made,

the conditions of the contract shall not be considered fulfilled.

Fuel, water and electric power required for "Performance Tests" shall be provided by the Contractor.

Seven (7) copies of the Final Performance Test Report shall be submitted to the Engineer not later than one (1) month after completion of the performance tests.

4.6 Diesel Generator Set

4.6.1 **Measurement**

Measurement shall be made for one No. of diesel generator set (as per rating mentioned in BOQ), alongwith all its allied accessories acceptably supplied and installed by the Contractor as a complete job.

4.6.2 **Payment**

Payment shall be made for one No. of DG Set alongwith all its allied accessories, as provided above, at the Contract unit price each for design, fabricating, supplying, installing, testing, and commissioning of the of diesel generator set (as per rating mentioned in BOQ), including fixing arrangement and accessories for complete installation.

SUPPLY, INSTALLATION AND TESTING

SCHEDULE OF TECHNICAL DATA TO BE FILLED IN FOR EVERY TYPE/RATING OF DG SETS AND SEALED/STAMPED BY THE MANUFACTURER- (MANDATORY)

Sr. No	Data Required	Data To Be Submitted (By Bidder)
1	**ENGINE**	
	Manufacturer's Name/ Country of Origin	
	Model	
	Maximum Engine Rating -(BHP)	
	Continuous Output Rating -(BHP)	
	Derating Factor:	

	(i) For Altitude of 1250 meters above MSL	
	(ii) For inlet Air Temperature of	
	(iii) Others if any	
	Engine Rating at Site-(BHP)	
	Period of maximum Engine Rating in Hours	
	Operating speed-RPM	
	Piston Speed (m/s)	
	Bore & Stroke-Inches	
	No. of cylinders	
	Arrangement of Cylinders (in line/v)	
	Engine Capacity-Cu.in./cc	
	Compression Ratio	
	Coupling Type	
	Mounting Arrangement	
Sr. No	**Data Required**	**Data To Be Submitted (By Bidder)**
	Cooling System	
	Ignition System	
	Overload Capability	
	Governor Type And Make	
	Efficiency at 0.85 pf % At 25% of rated load At 50% of rated load At 75% of rated load At 100% of rated load	_ _ _ _

	Lube oil consumption (Liters/hr) At 0% of rated load At 25% of rated load At 50% of rated load At 75% of rated load At 100% of rated load	_ _ _ _ _
	Specific Fuel consumption (Liters/hr) At 0% of rated load At 25% of rated load At 50% of rated load At 75% of rated load At 100% of rated load	 _ _ _ _ _
	Lubrication system nominal oil pressure (kg/cm^2)	
	Lubrication system minimum oil pressure (kg/cm^2)	
	Lubricating oil Sump capacity (ltr.)	
	Radiator capacity (ltr.)	
	Compusion air intake at 50 Hz (cm^3)	
	Engine heat radiation (K cal/min.)	
	Exhaust gas temperature at manifold, deg C.	
	Exhaust gas rate (ltr/sec.)	
	Starting system voltage (v)	
	Specific Feature if any	

Sr. No	**Data Required**	**Data To Be Submitted (By Bidder)**
2	**GENERATOR**	
	Manufacturer's Name/ Country of Origin	
	Model	
	Design Rating -(KVA)	
	Continuous Output Rating -(KVA)	

	Net electrical Output at site -(KVA)	
	Rated Voltage-volts	
	Power Factor	
	Speed-(RPM)	
	Frequency-Hz	
	Type designation	
	Time delay	
	(i) Manufacturer	
	(ii) Type designation	
	Timing	
	(i) Manufacturer	
	(ii) Type designation	
	Tripping	
	Insulation class	
	Stator Rotor Exciter	
	Overload Capability %	
	Harmonic Content %	
	Temperature Rise ^{0}C	
	Voltage Regulation	

Sr. No	Data Required	Data To Be Submitted (By Bidder)
	Type	
	Regulator	
	Regulation %	
	Voltage Dip %	
	Response Time (Sec)	
	Frequency Regulation -%	
	Deviation Factor %	
	Efficiency at 0.85 pf % At 25% of rated load At 50% of rated load At 75% of rated load At 100% of rated load	
	Exciter	
	Type	
	Rated Voltage-Volts	
	Full load current -Amps.	
	Radio Frequency Interference	
	Telephone interference factor	
	Charge Capacity	
	Batteries Type Rating-AH	
	Noise output level of Set (dB) At 0 % of rated load At 25% of rated load	

	At 50% of rated load At 75% of rated load At 100% of rated load	
Sr. No	**Data Required**	**Data To Be Submitted (By Bidder)**
	De-rating Factor	
	For Altitude of given height in meters above MSL of the site of installation	
	For ambient temperature of	
	others ,if any	
	Special features, if any	
3	**ACCESSORIES**	
	(Contractor to state if any of the following accessories will be supplied - give details) Crankcase Heater Automatic water Makeup System Ducting for radiator Exhaust System Silencer Fuel Day Tank Fuel Piping System Fuel pump	
	Meters/Gauges to indicate: Engine speed in rpm Lube oil Pressure in Bars Lube oil temperature in ^{0}C Engine running hours in hrs. Battery Charging current in Amps.	
	Alarm/Indicating lamps for	

	Engine Overspeed Low lube oil pressure High engine water temperature Over voltage Under voltage Short-circuit/tripping of main circuit breaker low fuel level	
Sr. No	**Data Required**	**Data To Be Submitted (By Bidder)**
	High fuel level Winding temperature high Over cranking Low oil level High oil level Charging alternator failure	
	Safety devices for instantaneous shut down due to Engine over speed Low lube oil pressure High water temperature shut down	
	Safety devices for adjustable delayed shut down, through shut down timer, due to: Over voltage Short circuit/tripping of main circuit breaker Low fuel oil in tank Winding temperature high	

Note: To be filled for each rating of DG Set from the Manufacturer.

SECTION – 8121

7. DRY TYPE DISTRIBUTION TRANSFORMER

1.1 DESCRIPTION

A. Work Included:

1. The scope of work under this section includes the following for Dry –type distribution transformers with medium-voltage primaries as specified here in:

2. The contractor shall supply, install, commission & test dry cast resin transformer complete with connections, terminations and accessories. The cast resin transformer shall be designed and manufactured for continuous indoor operation in a tropical climate on a 3 phase distribution system with solidly earthed neutral. It shall be of a short circuit, impulse and moisture-proof design. The case resin transformer shall be designed, manufactured and tested according to the latest edition of International Electro technical Commission (IEC) Standard 60076-11. It shall be compact and suitable for easy installation on site.

3. The transformer shall be designed to operate in an enclosure of the protection class IP23 without de-rating.

4. The electrical connections to other equipment shall be properly coordinated to form a complete system (s) complying with this specification.

5. Workshop drawings shall be provided for each transformer. These drawings shall include fully dimensioned external and internal general arrangements showing all principle dimensions, weights, foundation/cable/bus bar entry details and the positions of all functional devices, schematic drawings showing all windings, method of connection, terminal markings, and IP rating.

6. Transformers in the context of this specification shall comprise assemblies of a magnetic core, primary and secondary windings, supporting framework and enclosure.

   Unless otherwise specified all terse used shall comply with IEC 60076-11 and DIN/VDE standards.

7. The design, manufacture, selection, installation, testing, commissioning and subsequent maintenance of all equipment and materials described in this specification shall comply with the requirements of, the electricity at work regulations and the IEE wiring regulations.

1.2 PROJECT

CONDITIONS

A. GENERAL

The transformers shall comply with the requirements of IEC 60076-11 in respect of partial discharge, impulse withstand short circuit strength.

B. Service Conditions: IEEE C37.121, usual service conditions

C. RATED VOLTAGE

Unless otherwise specified the rated voltage class of the primary windings shall be 11kV and secondary windings 0.400 kV, at a frequency of 50Hz. The windings shall be connected for vector group DYn 11.

D. THERMAL RATING

Transformers shall be designed and manufactured to operate continuously at the nameplate rating, in an ambient temperature not exceeding 50^{o}C and RH not exceeding 100%, unless otherwise specified.

The manufacturer shall confirm any de-rating necessary, should the transformers be required to operate in conditions exceeding those specified.

Transformers which are mechanically cooled shall have increased thermal range not less than 40% of the name plate rating.

E. LOSSES

Losses at no-load and loaded conditions shall be the lowest achievable for the transformer type specified. These losses shall be stated in the schedule(s) which accompany this Specification.

F. NOISE LEVELS

The manufacturer shall confirm the guaranteed noise levels, Measurement of sound levels shall comply with IEC 60076-10. The transformer shall be provided with noise reduction support blocks in order to reduce noise level.

G. ELECTROMAGNETIC COMPATIBILITY

Radiation of electromagnetic signals shall not exceed the limits of BS 800 and BS 6667. Where transformers may be vulnerable to voltage transients, they shall be protected by surge suppressor, which will reduce transients below the levels of the type tests.

1.3 QUALITY ASSURANCE

A. Electrical components, Devices and Accessories; Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

1.4 SUBMITTALS

A. Comply with requirements of all project specifications

B. Product data: For each type and size of transformer indicated.

C. Shop drawings: Diagrams including power signal and control wiring.

D. Manufacturer seismic qualification certification: Submit certification that transformers, accessories, and components will withstand seismic forces.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the list of manufacturers.

2.2 DESIGN REQUIREMENTS:

A. CORE CONSTRUCTION

The transformer core shall be built of lamination, comprising grain orientated silicon sheet steel which is insulated on both sides. To protect the core against corrosion and improve noise levels the core assembly shall be coated after assembly with resin based paint.

The lamination shall be clamped at top and bottom by steel channels, which are interconnected by vertical steel bolts. The bottom steel channels shall be used to support the transformer and the top steel channel shall incorporate lifting lugs.

The bottom core clamping channels shall be bolted to supporting steel cross-channels placed at 90^{o} to the transformer length, such that the whole unit is stable and able to support the whole weight of the transformer with a safety factor of two. Wheels shall be fitted to the cross-channels which shall be bi-directional or steerable

The supporting cross-channels shall be insulated from the core- clamping channels by anti- vibration pads.

The core-clamping and supporting steel work after all forming, drilling and shaping operations shall be thoroughly digressed and rinsed prior to application of a zinc phosphate primer, rinsed again and finally coated with an oven baked epoxy paint.

B. COIL CONSTRUCTION

Each transformer shall be a double wound type with both the H.V. and L.V. windings individually encapsulated in rigid steel mould. The coils shall be

impregnated with quartz filled epoxy resin and cast under vacuum, to produce a smooth finish without voids and undulations.

The size and spacing of the conductors used in the windings shall be such that the coils are self-supporting prior to impregnation and where applicable, shall allow the epoxy resin to fill all of the space in and between adjacent layers and turns.

The coefficients of expansion of the windings and epoxy resin shall not differ by more than 15%. The windings shall be made of copper, utilizing round or rectangular sections, or foil, as detailed in the attached schedule(s)

C. MECHANICAL FORCED VENTILATION (AF)

Where specified mechanical forced ventilation shall be employed to further cool the transformer windings and thus increase the performance rating during short highly loaded periods.

The cooling system shall be automatically controlled by sensing the low voltage top winding temperature.

The system shall comprise a number of single-inlet, single-width centrifugal fans, each connected to a discharge duct situated directly below the transformer coils, or axial fans, situated to direct the air flow through the coils.

Duct work shall be of sheet metal construction to DW/142 low pressure classification, or of greater thickness to suit manufacturing procedures, or incorporated as part of the base frame construction if required.

Ducts shall have discharge outlets, protected with metal mesh screens to exclude debris, to correspond with core positions on each side. Ends shall be capped.

Fans shall have spigot inlets, with 6 mm protective wire guard, and flanges outlets to connect to mating flanges on the air ducts, and joint to incorporate a flexible gasket.

Fans shall be direct driven by an internally fitted external rotor type motor with extended lubricators.

Each motor shall be supplied from a starter, complying with DIN/VDE standards and shall be housed in a purpose-mad cabinet also accommodating automatic control elements and status indication lamps.

The duty of each fan shall be identical and selected so that the total quantity of air delivered is sufficient to maintain the transformer temperature within the specified limits.

Fans shall be type tested to DIN/VDE Standards Impeller shall be mild steel to DIN/VDE standards and of welded construction, shaft height machined steel, bearings roller type or sealed for life. Fan scrolls shall be of welded construction.

For shaft powers below 1kW stamped formed strip impellers may be used provided required efficiency and balance grade can be achieved.

Where fan static pressure is less than 1kpa lock-formed joints and spot welds may be used. Fans and ductwork shall have a fully protective paint system to the same standard as the core construction.

D. INTERTURN INSULATION

High and low voltages coils shall be provided with very high integrity inter turn insulation to Class F, to withstand the thermal and mechanical stresses under the specified operating conditions.

E. MOUNTING OF COILS

Coils shall be sandwiches between the core clamping channels but separated from them by insulated support blocks. These blocks shall be radially located top and firmly fixed to withstand vibration and absorb coil expansions and contractions.

F. INSULATION CLASS

The HV and L.V windings shall be of insulation class F in respect of mechanical and electrical strength (Partial Discharge Test). The maximum continuous operation temperature shall be within the limit of the maximum system temperature according to IEC 60076-11 i.e. 155^{O}C. The maximum temperature rise shall be limited to 90K at 50^{O}C ambient. The transformer shall operate at higher ambient temperature with reduced load without getting damaged.

G. DEGREE OF PROTECTION

When specified, a transformer enclosure shall be designed to suit the location and anticipated environmental conditions. This shall provide a degree of protection not less than IP23 in compliance with IEC 60529, and shall comply with there Electricity at work Regulations.

H. TYPE OF RESIN, FILLER ETC

The particular manufacturer's insulation system shall dictate the type of resin and filler but the following guidelines shall be complied with.

The resin shall ensure a minimum power frequency breakdown stress 10kV/mm when tested to IEC 60243.

The completed cast resin coil shall be self-extinguishing in the event of fire. The testing method shall comply with IEC, DIN/VDE standards. Type test certificates are required to confirm the above.

2.3 DRY-TYPE DISTRIBUTION AND POWER TRANSFORMERS

A. Description:

Cast Resin and with insulation system rated at 220^0C with and 80^0C average winding temperature rises above a maximum ambient temperature of 50^0C.

B. Primary Connection: Air Terminal compartment with removable cover and predrilled copper bus bars.

C. Secondary Connection: Air terminal compartment with removable cover and predrilled copper bus bars.

D. Secondary Connection: Transition terminal compartment with connection pattern to match switchgear.

E. Insulation: Rated at 220^0C with temperature rise of 115^0C, maximum rise above 450C

F. Basic Impulse Level: 95 kV

G. Full-Capacity Voltage Taps: Four, 2.5 percent taps, 2 above and 2 below rated primary voltage; with externally operable de-energized, tap changer; position indicator and padlock hasp.

H. Cooling System: Force cooled.

I. Sound level may not exceed sound levels listed in BS, without fans operating.

J. Impedance: 6.0 percent.

K. High Temperature Local, audible and visual alarm and contacts for alarm

PART 3 EXECUTION

3.1 INSTALLATION

A. Install and anchor transformers on concrete bases according to manufacturer's written instructions and according to seismic codes applicable to project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit and 4 inches (100 mm) high.

2. Use 3000-psi (20.7 – Mpa), 28 day compressive strength concrete and reinforcement as specified in Division 03 Section "Cast in Place Concrete".

3. Install dowel rods to connect concrete bases to concrete floor. Unless otherwise indicated, install dowel rods on 18 inch (450 mm) centers around full perimeter of base.

4. Anchor equipment with epoxy embedded anchor bolts that extend through concrete base and anchor into structural concrete floor.

B. Maintain Minimum clearness according to manufacturer's written instructions and NFPA 70.

3.2 HANDLING FACILITIES

A. LIFTING

Transformers shall be provided with permanently fitted lifting lugs or eye bolts to facilitate handling by crane or hoist.
Transformers shall be equipped with jacking points to facilitate the removal and or insulation pads.

The bottom supporting steel work shall be fitted with holes or have lugs attached for the attachment of hauling apparatus.

B. FRAME WHEELS

Transformers shall be designed for floor mounting and be provided with removable bi- directional or steerable rollers.

The rollers shall be lockable or means provided to prevent movement of the transformers after Installation.

3.3 CONNECTION FACILITIES

A. CONNECTION METHODS

Connection methods shall comply with IEC 60076 Provision shall be made by the manufacturer for the mounting and connection of cable boxes and/or bus bars as specified for the HV and LV conductor connections.

Where HV and LV cable boxes and/or bus bars are specified these shall generally be arranged on opposite sides of the transformer. However exact positions shall suit the specified requirements of each individual situation.

LV cable terminations shall be kept separate from the HV cable connections and insulated to the specified voltage and able to withstand the specified short circuit currents.

All HV coil interconnections shall be insulated for the specified voltage, and able to withstand the specified short circuit currents.

An earthing terminal shall be provided at a convenient point on the supporting steel work. All steel work shall be bonded to the earthing terminal if it is not electrically continuous. Provision shall be made for making an earth connection to the neutral of the LV windings, should this be required.

B. TERMINAL MARKINGS

HV and LV winding terminals shall be clearly marked with characters in accordance with IEC 60076.

The characters shall be stamped or engraved on securely fixed, durable and non-corrodible plates.

3.4 TAP CHANGING FACILITIES

A. TAP CONNECTIONS AND LINKS

Each transformer shall be provided with tapping on the HV winding to cater for supply voltage variations in the range +2.5% and + 5% in compliance with IEC 60076.

Tap changing shall be effected by off-circuit tapping links.

A visible warning notice shall be fixed adjacent to the tapping links and worded as follows:

"WARNING - OFF LOAD TAP CHANGING LINKS – ISOLATE HV AND LV SUPPLIES TO TRANSFORMER BEFORE OPERATION"

3.5 THERMAL PROTECTION

Each transformer shall be provided with a system of thermal protection and temperature monitoring.

Temperature sensing thermistors shall be mounted in each LV coil as close as practicable to its hot spot. The thermistors shall be wired back to an electronic controller fitted on the transformer.

The thermistors shall be used to indicate winding temperature, and provide alarm and trip indications, and to operate forced cooling fans and trip HV circuit breakers where specified. Volt- free contacts shall be provided for relaying signals to remote equipment.

Wiring from the thermistors to the temperature controller shall be carried out with single core copper cables to DIN/VDE standards with LEF insulation. Cables shall be contained in galvanized steel conduit supported from the transformer steel work.

The temperatures at which the cooling fans shall be switched on and off shall be adjustable within preset limits.

The power supply for the cooling fans shall be provided from the particular transformer via a suitably fused switch. This switch shall bear the inscription in yellow letters on a black background:

WARNING - SUPPLY FOR TRANSFORMER COOLING FANS - DO NOT SWITCH OFF

The starter assembly for the cooling fans shall comply with this Specification. A warning label shall be fixed adjacent to the main isolating switch bearing the inscription:

WARNING - SUPPLY FOR TRANSFORMER COOLING FANS - DO NOT SWITCH OFF

3.6 RATING PLATES

Rating plates shall be fitted complying with IEC 60076-11

3.7 FOLLOW-UP SERVICE

A. Voltage Monitoring and Adjusting:

Perform the following voltage monitoring after substantial Completion but not more than six months after Final Acceptance.:

1. During a period of normal load cycles, perform seven days of continuous three phase voltage recording at secondary terminals of each transformer. Voltage unbalance greater than 1 percent between phases, or deviation of any phase voltage from nominal value by more than plus of minus 5 percent during test period is unacceptable.

2. Corrective Action: If test results are unacceptable, perform the following corrective actions, as appropriate.

   a. Adjust transformer taps.

   b. Prepare written request for voltage adjustment by electric utility.

3. Retest: After corrective actions have been performed repeat monitoring until satisfactory results are obtained.

4. Report: Prepare written report covering monitoring and corrective actions performed.

3.8 TESTING INSPECTION AND COMMISSIONING

The tests to be carried out in accordance to IEC 60076-11 and in presence of owner's consultant and owner at factory. Test report shall be provided and shall include but not necessarily be limited to :

A. Visual and Mechanical Inspection

1. Inspect physical and mechanical condition including evidence of moisture and corona.

2. Inspect anchorage, alignment, and grounding.

3. Prior to cleaning the unit, perform as-found tests, if required.

4. Clean the unit.

5. Verify that control and alarm settings on temperature indicators are as specified.

6. Verify that cooling fans operate.

7. Inspect bolted electrical connections for high resistance using one of the following methods:

   - Use of low-resistance ohmmeter
   - Verify tightness of accessible bolted electrical connections by calibrated torque- wrench method.
   - Perform thermo graphic survey.

8. Perform specific inspections and mechanical tests as recommended by manufacturer.

9. Perform as-left tests.

10. Verify that as-left tap connections are as specified.

11. Verify the presence of surge arresters.

B. Electrical Tests

1. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.

2. Perform insulation-resistance tests winding and each winding ground with test voltage. Calculate polarization index.

3. Perform power-factor or dissipation-factor tests in accordance with the test equipment manufacturer's published data.

4. Perform a power-factor or dissipation-factor tip-up test.

5. Perform turns-ratio tests at the designated tap position.

6. Perform an excitation-current test on each phase.

7. Measure the resistance of each winding at the designated position.

8. Measure core insulation-resistance at 500 volts dc if core is insulated and if the core ground strap is removable.

9. Perform an over potential test on all high- and low-voltage windings-to-ground.

10. Verify correct secondary voltage phase and phase neutral after energization and prior to loading.

C. Test Values

1. Compare bolted connection resistances to values of similar connections.

2. Bolt-torque levels should be in accordance with IEC 60076 unless otherwise specified by manufacturer.

3. Micro ohm or mV drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's data is not available, investigate any values which deviate from similar connections by more than 50 percent of the lowest value.

4. Insulation-resistance test values at one minute should be in accordance with IEC60076.

5. The polarization index shall be compared to previously obtained results and should not be less than 1.0.

6. Turns-ratio test results should not deviate more than one half percent from either the adjacent coils or the calculated ratio.

7. CH and CL power-factor or dissipation-factor values will vary due to support insulators and bus work utilized on dry transformers. The following should be expected on CHL power factors:

- Distribution transformers: 5.0 percent or less
- Consult transformer manufacturers or test equipment manufacturer's data for additional information.

8. Tip-up test watts loss values should indicate no significant increase in power factor.

9. Temperature corrected winding-resistance test results should compare within one percent of previously obtained results.

10. Typical excitation current test data pattern for three-legged core transformer is two similar current readings and one lower current reading.

11. Core insulation-resistance values should be comparable to previously obtained results but not less than one mega ohm at 500 volts dc.

12. AC over potential test shall not exceed 65 percent of factory test voltage for one minute duration. DC over potential test shall not exceed 100 percent of the AC r.m.s test voltage specified in ANSI C57.12.91, Section 10.2 for one minute duration. The insulation should withstand the over potential test voltage applied.

D. SITE TESTS

All site tests shall be carried out in accordance with this Specification.

After delivery to site each transformer shall be inspected in the presence of the Owner's consultant, prior to installation.

After installation on properly prepared foundations each transformer shall be tested and inspected in the presence of the Owner's consultant.

The HV and LV winding connections shall be demonstrated as providing the specified polarity and phase rotation and tap connections.

The HV and LV windings shall be tested for continuity and insulation resistance with a 1000v insulation tester. The insulation resistance between adjacent windings shall not be less than 100 M ohm.

After the HV windings are energized, it shall be demonstrated that the voltage and phase rotation at the LV terminals are as specified.

3.9 **PARTICULAR REQUIREMENT** – ACCESS

The specified transformers are located as indicated on the drawings.

This places restrictions on the transformers' physical dimensions in case it is necessary to remove/replace a transformer once the installation is handed over and in use.

The Contractor shall demonstrate to the Owner's consultant that the manufacturer's transformer type selected could be removed/replaced (without incurring builders work) with access through the proposed location.

If required by the Owner's consultant, detailed dimensioned drawings proving removal/replacement is practical shall be provided.

3.10 TECHNICAL REQUIREMENTS

HV Supply System	11000V
. Number of phases	3 phase
. System neutral	not applicable
. Fault level (nominal design)	500 MVA
LV Supply System	
. No-load voltage	400V
. Number of phases	3 phase
	4 wire
Ambient temperature	**50^0C**
Supply Frequency (HZ)	50 HZ HV winding connection
Delta LV winding connection	Star Vector group reference
DYN 11	
Impedance at 75^o C	6%
HV Tapping (% of no-loads volts)	+ 2.5% and + 5%
Method of cooling	(ANAF) Air Natural + Air Forced ventilation for at least 40% extra rating
Secondary voltage at:	
. Full load	380 V
. No load	400 V
Rated Voltage	11000 V 400/230V
HV Insulation Level	12 KV 1.1 KV
. Impulse KV Peak	95 BIL -
. Power Frequency (KV RMS)	28 KV 3 KV
Paint finish color	Manufacturer Standard
HV conductor and type	Top entry bus-way/XLPE Cables
LV conductor and type	Top entry bus-way/Cables
Indoor or outdoor	Indoor – refer to layout
Installation/space limitations	drawing
Coil material (HV)	Copper
Coil material (LV)	Copper

SECTION - 8132

8. LOW VOLTAGE SWITCHBOARDS, MAINTENANCE BY-PASS SWITCH, POWER FACTOR IMPROVEMENT PLANT AND BUS TIE DUCT

1.0 SCOPE OF WORK

The work under this section consists of design, manufacturing, fabricating, supplying, installing, testing, and commissioning of all material and services of the complete LV (LV) (415 Volt) switchboard, Maintenance By-Pass Switch (MBS), Power Factor Improvement (PFI) Plant and Bus Tie Duct (BTD) for indoor installation as specified herein, shown on the Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the electrical equipments and power & control cables layout with the Engineer and co-ordinate at site with other services for exact locations and positions of the electrical lines and equipments.

The LV (415 Volt) switchboards, MBS, PFI Plant and BTD with all other required accessories shall also comply with the General specifications for Electrical Works Section-8001 and with other relevant provisions of the Documents.

2.0 GENERAL

2.1 Low Voltage (415 Volt) Switchboard

The LV (415 Volt) switchboard shall be sheet steel fabricated. The LV (415 Volt) switchboard shall be free standing cubicles on floor.

The free standing cubicles shall be modular in design with facility and provisions for expansion/ addition of additional cubicles in future

These shall be suitable for indoor installation on cable trenches. The LV (415 Volt) switchboard shall be totally enclosed, dust and damp proof. The LV (415 Volt) switchboard shall be complete in all respects with material and accessories, factory assembled, tested and finished according to the Specifications and to the normal requirements.

All components of LV (415 Volt) switchboards shall be installed on a common mounting plate inside the enclosure. The enclosures of LV (415 Volt) switchboards and Bus Tie Duct shall be provided with rubber gasket and a lockable hinged door with cam fastener. The switching lever of the Main incoming Air Circuit Breaker (ACB)/Moulded Case Circuit Breaker (MCCB) of LV (415 Volt) switchboards shall be accessible from outside of the panel doors in closed position. Switching levers of all outgoing MCCBs

and MCBs shall only be accessible with the panel doors in open position.

The LV (415 Volt) switchboards shall be supplied complete with all installation materials as recommended by the manufacturer. The incoming and outgoing cable connections shall be according to the wiring requirements. If required, an adapter box for LV (415 Volt) switchboards to accommodate the cables and conduits may be provided. The box shall be of the same material and finish as the switchboard.

The cabling inside the switchboard shall be suitably harnessed by means of straps or cords. For the LV (415 Volt) switchboards an earth bar or terminal strips shall be provided for connection of incoming and outgoing earth conductors. The earth bar or terminals shall be permanently connected to the body of switchboard at two points.

The LV (415 Volt) switchboards, in general, shall;

- be suitable for indoor installation & operation
- be suitable for operation and maintenance from front side
- be suitable for 415 Volt, 3 phase 4 wire, 50 Hz system
- have all components rated for insulation class of 600V min
- be designed for flush mounting of all instruments on the front
- be provided with adequate clearance from live parts so flash overs can not be caused by switching, vermin, pests, etc.
- have incoming/outgoing cable termination arrangements. The power cables shall be directly connected to the terminals of TP 500V MCCBs of current ratings of 100 Amps and above. The SP/TP MCBs and/or MCCBs of current ratings upto and including 100 Amps shall be connected to DIN rail mounted wiring terminals of appropriate ratings, numbers and sizes for the outgoing wiring cables
- be provided with name plate on the front side of door for each incoming/outgoing circuits
- be provided with pocket inside of door for safe keeping of the detailed as-built wiring/ shop diagrams of the switchboard

- have provisions for incoming and outgoing cables entry, connections and termination arrangements from top and/ or bottom plates as per site requirements

- have all openable doors grounded with the use of flexible copper cable/strip of 10 sqmm cross-sectional area, at least

2.2 Maintenance By-Pass Switch (MBS)

The Maintenance by-pass switch shall be used for supply of power either from power transformer or DG set in case of faults in AMF Panel.

2.3 Power Factor Improvement (PFI) Plant

The Power factor Improvement Plant shall be used for improving the system power factor to keep the same within the limits as prescribed by WAPDA.

2.4 Low Voltage (415 Volt) Bus Tie Duct (BTD)

The LV (415 Volt) Bus Tie Duct shall be sheet steel fabricated. The LV (415 Volt) Bus Tie Duct shall be suitable for indoor installation. The Bus Tie Duct shall be suitable for indoor mounting on CC wall and RCC columns surfaces as shown on the drawings. The Bus Tie Duct shall be totally enclosed, dust and damp proof.

The Bus Tie Duct shall be designed to withstand a short circuit as specified for the associated LV switchboard. The current rating shall be as given in Bill of Quantities. The Bus-Tie Duct shall be three phase and neutral, rated for 415 Volt, 50 Hz system.

The LV (415 Volt) Bus Tie Duct shall be complete in all respects with material and accessories, factory assembled, tested and finished according to the Specifications and to the normal requirements.

The Contractor shall supply the bus-tie duct keeping in view all the installation, operation and maintenance factors as per site conditions and requirements and shall be solely responsible for the proper design configurations and dimensions of the bus-tie duct for complete alignment.

The LV (415 Volt) Bus Tie Duct, in general, shall;

- be suitable for indoor installation & operation
- be suitable for operation and maintenance from front/ rear sides

- be suitable for 415 Volt, 3 phase 4 wire, 50 Hz system
- have all components rated for insulation class of 600V min
- have name plates on the front & rear sides at every 5 meter
- have suitable provisions for incoming and outgoing cables entry, connections, termination arrangements as per site requirements
- have all openable doors grounded with the use of flexible copper cable/strip of atleast10 mm^2 cross-sectional area

3.0 APPLICABLE STANDARDS/CODES

The latest editions of the following standards and codes shall be applicable for the materials specified within the scope of this Section :

IEC 947	-	Triple pole Air Circuit Breakers
BS 4752-1	-	Triple pole Moulded Case Circuit Breaker
VDE 0641	-	Single and Triple pole Miniature Circuit IEC 947 Breaker
IEC 947	-	LV Switch gear and Control gear
IEC 439	-	Factory Built Assemblies of LV Switchgear
IEC 4752	-	Switch gear and control gear for Voltages upto and including 1 kV
BS 88	-	HRC Fuses
IEC 73	-	Colors for indicator lights and push buttons.
IEC 446	-	Identification of insulated/bare conductors

4.0 MATERIAL

4.1 Low Voltage (415 Volt) Switchboard

4.1.1 Sheet Metal Work

The enclosures for the LV (415 Volt) switchboards shall be fabricated with 14 SWG sheet steel. The front doors shall be fabricated with 12 SWG sheet steel.

The complete sheet steel metal work of the LV (415 Volt)

switchboards shall be:

- cleaned down to bare shining metal
- de-rusted and de-greased
- painted with two base coats of anti-corrosive RED oxide paint.
- Two coats of weather proof powder paint in approved colour.

4.1.2 **Components**

The LV switchboard shall be provided with components as specified in these specifications, mentioned in the Bill of Quantities, as shown on the Drawings required for the satisfactory operation of the switchboard and of the electrical system.

Typical component specifications are given below:-

4.1.2.1 **Bus Bars**

The bus bars shall be made of high conductivity electrolytic copper and shall be completely isolated and mechanically braced for the specified fault level. The phase identification of bus bars shall be by colours applied on bus bars and these shall be red, yellow and blue for phases and white for neutral. The earth bus bar shall be green.

The bus bars shall be triple pole and neutral and shall be of appropriate size to meet the electrical and mechanical requirements of the system. The temperature rise shall not exceed 45 degrees centigrade at rated current.

4.1.2.2 **Moulded Case Circuit Breaker (MCCB)**

The MCCB shall be moulded case, triple pole, rated for 415 Volt AC. The Operating current ratings and Rupturing capacities shall be as mentioned in the relevant items of the Bill of Quantities and as shown on the drawings. The MCCBs shall have fixed Magnetic Short circuit and fixed Thermal Overload protections. All incoming Triple pole circuit breakers shall be MCCBs.

The Moulded Case Circuit Breakers shall be installed in the LV switchboards such that the Switching levers of Main Incoming MCCB and all outgoing MCCBs and MCBs shall be accessible from inside the front of the

panel with the front door in closed position. Circuit numbers and designation on all circuits shall be clearly marked to facilitate connection and maintenance.

4.1.2.3 **Miniature Circuit Breaker (MCB)**

The MCBs shall be Single pole 250 Volt and Triple pole 415 Volt of current ratings as shown on the drawings. These shall have fixed magnetic short circuit and fixed thermal overload protections. The Single pole and Triple pole miniature circuit breakers shall have a 10,000 Amperes short circuit breaking capacity as per International standards IEC 157 Category P2.

The Miniature Circuit Breakers shall be installed such that their switching levers are accessible through the front plate inside the switchboards for operations. Circuit Numbers and Designation on all circuits shall be clearly marked to facilitate connection and maintenance. These Circuit Breakers shall be suitable for working on lighting and power circuits.

4.1.2.4 **Air Break Magnetic Contactors**

The contactors shall be air break, triple pole, 415 Volt suitable for the type of duty to be performed. The main contacts shall be silver tipped, butt type with double break per pole. Each contactor shall be provided with 230 Volt, AC single phase operating coil, and minimum two normally open (NO) and two normally closed (NC) auxiliary contacts wired upto terminals. The number of working auxiliary contacts shall be provided according to the system requirements.

4.1.2.5 **Push Buttons**

Push buttons shall be momentary make break contact type (normally open/normally close). These shall be suitable for flush mounting on switchboard, plastic faceplate etc. Push buttons shall have round/square head. These shall be of red color for 'ON' and green color for 'OFF' operations.

4.1.2.6 **AC Voltmeters**

AC Voltmeters shall be digital type and shall be suitable for flush mounting on front door of the switchboards. The front dimensions shall be 96 mm Wide and 48 mm high. The voltmeters shall have 3-1/2 digit, 0.55-inch display. The AC digital voltmeters shall have measuring range of 0 to 1999 Volt AC. It shall be suitable for power supply of

110/220 Volt AC ±10% at 50/60 HZ.

4.1.2.7 **Ammeters**

AC Ammeters shall be digital type and shall be suitable for flush mounting on front door of the switchboards. The front dimensions shall be 96 mm wide and 48 mm high. The Ampere meters shall have 3-1/2 digit, 0.55-inch display. The AC digital voltmeters shall have measuring ranges as shown on the drawing and given in the Bill of Quantities. It shall be suitable for power supply of 110/220 Volt AC ±10% at 50/60 Hz.

4.1.2.8 **Voltmeter Selector Switch**

The voltmeter selector switch shall be complete with front plate, grip handle, and RY-YB-BR-OFF-RN positions.

4.1.2.9 **Ampere meter Selector Switch**

The ampere meter selector switch shall be complete with front plate, grip handle, and R-Y-B-OFF positions.

4.1.2.10 **Indicating Lamps**

Indicating lamps shall be suitable for flush mounting, complete with base, 230-Volt neon lamp and shall have rosettes of suitable colour.

4.1.2.11 **Current Transformers**

Air-cooled, ring type current transformers shall be provided having transformation ratio as indicated on the drawings. The current transformers shall be of suitable burden having accuracy class 1.0 and have 5 amps secondary.

4.1.2.12 **Line up Terminals**

Line up terminals wherever provided for control of lighting, power and control circuits shall be suitable for voltage and size of conductors as indicated on drawings and as mentioned in the respective BOQ items. The line-up terminals shall be suitable for channel mounting. All necessary accessories such as end-plates, fixing clips, transparent label holder caps and label sheets with marking shall be provided.

4.2 **Low Voltage (415 Volt) Bus Tie Duct**

4.2.1 **Sheet Metal Work**

The complete enclosures for the LV (415 Volt) Bus Tie Duct shall be fabricated with 14 SWG sheet steel.

The complete sheet steel metal work of the LV (415 Volt) Bus Tie Duct shall be:

- cleaned down to bare shining metal
- de-rusted and de-greased
- painted with two base coats of anti-corrosive RED oxide paint.
- Two coats of weather proof powder paint in approved colour.

4.2.2 **Components**

The LV Bus Tie Duct shall be provided with components as specified in these specifications, mentioned in the Bill of Quantities, as shown on the Drawings required for the satisfactory operation of the Bus Tie Duct and of the electrical system.

Typical component specifications are given below:-

4.2.2.1 **Bus Bars**

The bus bars shall be made of high conductivity electrolytic copper and shall be completely isolated and mechanically braced for the specified fault level. The phase identification of bus bars shall be by colours applied on bus bars and these shall be red, yellow and blue for phases and white for neutral. The earth bus bar shall be painted green.

The bus bars shall be triple pole and neutral and shall be of appropriate size to meet the electrical and mechanical requirements of the system. The temperature rise shall not exceed 45 degrees centigrade at rated current.

4.2.2.2 **Insulators**

The insulators for mounting of Busbars shall be suitable for 3 phase, 4 wire, 415 Volt AC operation as shown on the drawings.

4.2.2.3 **Insulating supports**

The insulating supports for mounting of busbars inside

the sheet steel enclosure shall be of suitable material and thickness to provide the required insulation. These shall also be suitable to withstand the physical weights of the busbars.

4.2.2.4 **Nuts, Bolts and Washers**

The nuts, bolts and washers for the Bus Tie Duct shall be made of galvanized steel suitable for long life operation.

4.3 **Power Factor Improvement (PFI) Plant**

4.3.1 **Sheet Metal Work**

The complete enclosures for the Power Factor Improvement Plant shall be fabricated with 14 SWG sheet steel.

The complete sheet steel metal work of the Power Factor Improvement Plant shall be:

- cleaned down to bare shining metal
- de-rusted and de-greased
- painted with two base coats of anti-corrosive RED oxide paint
- Two coats of weather proof powder paint in approved colour

4.3.2 **Components**

The Power Factor Improvement Plant shall be provided with components as specified in these specifications, mentioned in the Bill of Quantities, as shown on the Drawings required for the satisfactory operation of the Power Factor Improvement Plant and of the electrical system.

Typical component specifications are given below:

4.3.2.1 **Bus Bars**

The bus bars shall be made of high conductivity electrolytic copper and shall be completely isolated and mechanically braced for the specified fault level. The phase identification of bus bars shall be by colours applied on bus bars and these shall be red, yellow and blue for phases and white for neutral. The earth bus bar shall be painted green.

The bus bars shall be triple pole and neutral and shall be of appropriate size to meet the electrical and mechanical requirements of the system. The temperature rise shall not exceed 45 degrees centigrade at rated current.

4.3.2.2 **Insulators**

The insulators for mounting of busbars shall be suitable for 3 phase, 4 wire, 415 Volt AC operation as shown on the drawings.

4.3.2.3 **Insulating supports**

The insulating supports for mounting of busbars inside the sheet steel enclosure shall be of suitable material and thickness to provide the required insulation. These shall also be suitable to withstand the physical weights of the busbars.

4.3.2.4 **Nuts, Bolts and Washers**

The nuts, bolts and washers for the Bus Tie Duct shall be made of galvanized steel suitable for long life operation.

4.3.2.5 **Power Factor Regulator**

The Power Factor Regulator shall be suitable for sensing power factor in a Three Phase unbalanced load network. The Power Factor meter shall be digital. The regulator shall have provision for Automatic cum Manual operation. The operating voltage shall be same as that for the associated LV switchboard.

The Power Factor Regulator shall be microprocessor controlled for fast computer programming at site. It shall have provisions for sensing connection errors.

4.4 **Maintenance By-Pass Switch (MBS)**

4.4.1 **Sheet Metal Work**

The complete enclosures for the Maintenance By-Pass Switch shall be fabricated with 14 SWG sheet steel.

The complete sheet steel metal work of the Maintenance By-Pass Switch shall be:

- cleaned down to bare shining metal
- de-rusted and de-greased

- painted with two base coats of anti-corrosive RED oxide paint

- Two coats of powder paint in approved colour

4.4.2 **Components**

The Maintenance By-Pass Switch shall be provided with components as specified in these specifications, mentioned in the Bill of Quantities, as shown on the Drawings required for the satisfactory operation of the Maintenance By-Pass Switch and of the electrical system.

Typical component specifications are given below:

4.4.2.1 **Bus Bars**

The bus bars shall be made of high conductivity electrolytic copper and shall be completely isolated and mechanically braced for the specified fault level. The phase identification of bus bars shall be by colours applied on bus bars and these shall be red, yellow and blue for phases and white for neutral. The earth bus bar shall be painted green.

The bus bars shall be triple pole and neutral and shall be of appropriate size to meet the electrical and mechanical requirements of the system. The temperature rise shall not exceed 45 degrees centigrade at rated current.

4.4.2.2 **Insulators**

The insulators for mounting of Busbars shall be suitable for 3 phase, 4 wire, 415 Volt AC operation as shown on the drawings.

4.4.2.3 **Insulating supports**

The insulating supports for mounting of busbars inside the sheet steel enclosure shall be of suitable material and thickness to provide the required insulation. These shall also be suitable to withstand the physical weights of the busbars.

4.4.2.4 **Nuts, Bolts and Washers**

The nuts, bolts and washers for the Bus Tie Duct shall be made of galvanized steel suitable for long life operation.

4.4.2.5 **Air Break Magnetic Contactors**

The contactors shall be air break, triple pole, 415 Volt suitable for the type of duty to be performed. The main contacts shall be silver tipped, butt type with double break per pole. Each contactor shall be provided with 230 Volt AC single phase operating coil, and minimum two normally open (NO) and two normally closed (NC) auxiliary contacts wired upto terminals. The number of working auxiliary contacts shall be provided according to the system requirements.

4.4.2.6 **AC Voltmeters**

AC Voltmeters shall be digital type and shall be suitable for flush mounting on front door of the switchboards. The front dimensions shall be 96 mm Wide and 48 mm high. The voltmeters shall have 3-1/2 digit, 0.55-inch display. The AC digital voltmeters shall have measuring range of 0 to 1999 Volt AC. It shall be suitable for power supply of 110/220 Volt AC ±10% at 50/60 HZ.

4.4.2.7 **Voltmeter Selector Switch**

The voltmeter selector switch shall be complete with front plate, grip handle, and RY-YB-BR-OFF-RN positions.

4.4.2.8 **Indicating Lamps**

Indicating lamps shall be suitable for flush mounting, complete with base, 230-volt neon lamp and shall have rosettes of suitable colour.

4.4.2.9 **Line up Terminals**

Line up terminals wherever provided for control of lighting, power and control circuits shall be suitable for voltage and size of conductors as indicated on drawings and as mentioned in the respective BOQ items. The line-up terminals shall be suitable for channel mounting. All necessary accessories such as end-plates, fixing clips, transparent label holder caps and label sheets with marking shall be provided.

5.0 INSTALLATION

5.1 **Low Voltage (415 Volt) Switchboard**

The location of LV switchboards is shown diagrammatically on the drawings. The actual location shall be determined at site,

keeping in view the site conditions and in coordination with other equipment.

LV switchboard for floor mounting shall be installed on already prepared CC cable trenches. The LV switchboards shall be protected to avoid any damage due to the civil work.

All loose parts dispatched separately with the switchboard shall be installed as per manufacturer instructions and all adjustments or setting shall be made as required. All screws, nuts and bolts used for fixing the switchboard shall be galvanized.

The switchboards installation shall include connecting all incoming and outgoing cables. The cable entry in the boards shall be provided from top or bottom as required.

The switchboard body shall be connected to earth as per instructions given in section "Earthing" of these Specifications. The switchboard shall be tested and commissioned in the presence of the Engineer. The LV switchboards shall be tested before energizing as per instructions contained in the article "Testing" of General Specifications for Electrical Works, Section-8001 of these Specifications.

5.2 Low Voltage (415 Volt) Bus Tie Duct (BTD)

The Bus-Tie Duct shall be installed at the locations as shown on the drawings. All installation materials steel hangers brackets supports etc. as required and recommended by the manufacturer for safe erection shall be provided and installed by the Contractor without any additional cost. The bus tie duct shall be carefully aligned and all steel supports made of bolted connections using nuts bolts washers etc. shall be provided by the Contractor. All material and accessories shall be galvanized /rustproof. The section of copper bars of the bus tie duct requiring bolting together shall be thoroughly cleaned at site. A coat of conductive oxide inhibitor compound to be applied on the surface to be connected and the sections bolted together by means of torque wrenches using the bolts provided by the manufacturer. The bus tie duct shall be tested and commissioned in the presence of the Engineer or his representative at the manufacturer's works. After successful completion of tests the contractor shall furnish Test certificates. The bus tie duct shall be tested at site before energizing as per article “Testing” Section - 8001 of these Specifications.

5.3 Power Factor Improvement (PFI) Plant

The location of Power Factor Improvement Plant is shown diagrammatically on the drawings. The actual location shall be determined at site, keeping in view the site conditions and in

coordination with other equipment.

Power Factor Improvement Plant shall be installed on already prepared CC cable trenches. The Power Factor Improvement Plant shall be protected to avoid any damage due to the civil work.

All loose parts dispatched separately with the Power Factor Improvement Plant shall be installed as per manufacturer instructions and all adjustments or setting shall be made as required. All screws nuts and bolts used for fixing the Power Factor Improvement Plant shall be galvanized.
The Power Factor Improvement Plant body shall be connected to earth as per instructions given in section "Earthing" of these Specifications.

The Power Factor Improvement Plant shall be tested and commissioned in the presence of the Engineer. The Power Factor Improvement Plant shall be tested before energizing as per instructions contained in the article "Testing" of General Specifications for Electrical Works, Section-8001 of these Specifications.

5.4 **Maintenance By-Pass Switch (MBS)**

The location of Maintenance By-Pass Switch is shown diagrammatically on the drawings. The actual location shall be determined at site, keeping in view the site conditions and in coordination with other equipment.

Maintenance By-Pass Switch shall be installed on already prepared CC cable trenches. The Maintenance By-Pass Switch shall be protected to avoid any damage due to the civil work.

All loose parts dispatched separately with the Maintenance By-Pass Switch shall be installed as per manufacturer instructions and all adjustments or setting shall be made as required. All screws, nuts and bolts used for fixing the Maintenance By-Pass Switch shall be galvanized.

The Maintenance By-Pass Switch installation shall include connecting all incoming and outgoing cables.

The Maintenance By-Pass Switch body shall be connected to earth as per instructions given in section "Earthing" of these Specifications. The Maintenance By-Pass Switch shall be tested and commissioned in the presence of the Engineer. The Maintenance By-Pass Switch shall be tested before energizing as per instructions contained in the article "Testing" of General Specifications for Electrical Works (Section-8001).

6.0 MEASUREMENT AND PAYMENT

6.1 General

The Contractor's bid amount against each item of Bill of Quantities as given below shall include design, fabrication, supply, installation, testing, commissioning and completion for all works specified herein and/or as shown on the Drawing related to the item.

6.2 Low Voltage Switchboard

6.2.1 Measurement

Measurement shall be made for the number of each type/ designations of LV switchboards acceptably supplied, installed, tested and commissioned by the Contractor as a complete job.

6.2.2 Payment

Payment shall be made for the number of each type/designations of jobs measured, as provided above, at the Contract unit price each for design, fabricating, supplying, installing, testing, and commissioning of the LV switchboards, including fixing arrangement and accessories for complete installation.

6.3 Low Voltage Bus-Tie Duct

6.3.1 Measurement

Measurement shall be made for the running meters of each type of LV bus-tie duct acceptably supplied, installed, tested and commissioned by the Contractor as a complete unit.

6.3.2 Payment

Payment shall be make for the number of running meters of each type of units measured as provided above at the Contract unit prices each. The payment shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of the LV Bus Tie Duct including all installation materials such as hangers, brackets, supports, nuts, bolts, washers, sheet steel covers, ECC etc.

6.4 Power Factor Improvement Plant

6.4.1 Measurement

Measurement shall be made for the number of each type/ designations of Power Factor Improvement Plant acceptably supplied, installed, tested and commissioned by the Contractor as a complete job.

6.4.2 Payment

Payment shall be made for the number of each type/designations of jobs measured, as provided above, at the Contract unit price each for design, fabricating, supplying, installing, testing, and commissioning of the Power Factor Improvement Plant, including fixing arrangement and accessories for complete installation.

6.5 Maintenance By-Pass Switch

6.5.1 Measurement

Measurement shall be made for the number of each type/ designations of Maintenance By-Pass Switch acceptably supplied, installed, tested and commissioned by the Contractor as a complete job.

6.5.2 Payment

Payment shall be made for the number of each type/designations of jobs measured, as provided above, at the Contract unit price each for design, fabricating, supplying, installing, testing, and commissioning of the Maintenance By-Pass Switch, including fixing arrangement and accessories for complete installation.

9. FIRE DETECTION & ALARM SYSTEM

1.0 SCOPE OF WORK

The work under this section consists of designing, manufacturing, fabricating, supplying, installing, earthing, testing and commissioning of all equipment/ material and services of complete Fire Detection & Alarm System as explained in these Specifications, shown on the drawings, given in the schedule of prices, as directed by the Engineer and as per manufacturer's instructions.

The Contractor shall discuss the layout of the proposed Fire Detection & Alarm System with the Engineer and co-ordinate at site with other discipline/services/systems for exact route, location and position of various equipments of the system.

2.0 GENERAL

The System components shall be the products of a single make/supplier. All products shall be UL listed and FM approved, LPCB or Vds certified/approved, USA, UK, Europe or approved equivalent. The Fire Detection & Alarm System is intended for early detection & reporting of any accidental fire. The early reporting of the accidental fires shall help the staff to take necessary steps and measures for the safety of human lives and equipment.

The Fire Detection & Alarm system shall be intelligent, addressable, class A wired and supervised system. The Intelligent Control Panel shall display the exact address of the Automatic Fire detectors and manual call points employed in the system.

The Fire Detection & Alarm system shall be capable to monitor at least 120 numbers of addressable devices on each loop. The system shall operate on 24V (with a tolerance of +/-6V) DC from a battery charger with stand-by batteries. The incoming supply shall be 230 Volt AC +10% - 15%.

The system wiring and installation shall be in compliance with all applicable latest version standards/codes, and the manufacturer's instructions/ recommendations.

The system shall monitor and report the status of manual call points/stations and automatic fire detectors. The system shall also perform control functions as alarm indications, etc. The Intelligent system shall be fully programmable with alpha-numerical display.

The Main Control Panel shall have elegant finish. The finish color(s) of the Main control panel shall be as per relevant international standards.

The Fire Alarm Control Panel shall be equipped with the capability to integrate and communicate with the Building Management System (BMS).

The Contractor shall provide wall charts for the operation and maintenance of the Fire Detection & Alarm System. The wall charts shall contain following minimum information in both of English and Urdu languages. The characters of written instructions shall be Bold and minimum 6 mm high or as directed by the Engineer.

- Complete layout of the Fire Detection & Alarm system showing locations of all automatic detectors, manual call points and sounder zones in different Bright colors
- Operating and maintenance instructions
- Emergency instructions

The Fire Detection & Alarm System shall be of latest version/model as offered by brand / manufacturer and comprise of the following equipments but not limited to;

- Main Control Panel for the Fire Detection & Alarm system with LED/LCD/backlit indications, Push buttons for Alarm accept, Alarm silence, Alarm test, system reset, Key operated ON/OFF switch all required keys for programming of the system, etc.

- Mains Power supply system with 230 Volt AC, 50Hz, single phase input from building's power supply network

- Back up Power supply system suitable for 120 minutes uninterrupted operation of the system at full load

- Photo Electric Smoke Detectors with addressable bases

- Fixed temperature/Rate of rise Heat Detectors with addressable bases

- Manual Call Point/station with addressable base

- Sounder with flasher

- Any other equipment and / or accessories deemed necessary for the completion of the Fire Detection & Alarm system.

3.0 APPLICABLE STANDARDS AND CODES

The latest editions of following standards/codes as applicable for the materials covered within the scope:

BS 5839	-	Fire detection and alarm systems for buildings
BS 6387	-	Test method for resistance to fire for cables required to maintain circuit integrity under fire conditions.
BS 7629	-	Specification/Testing for fire resistant screened cables
BS 6387	-	Testing for fire resistant screened cables
BS 5445	-	Components of automatic fire detection systems detectors.
BS 5501	-	Electrical apparatus for potentially explosive atmospheres.
BS 7671	-	lEE wiring regulations
BS EN 54		Fire Detection and Alarm System
NFPA – 72 & 101		Fire detection and Alarm System Installation and Testing

Moreover, where applicable, the system and its installations shall be complied with relevant standards, regulation and recommendations of the UL (underwriters Laboratory, Inc.) or the FM (Factory Manual) and the LPCB (Loss Prevention Council Board) or approved equivalent.

4.0 MATERIAL

4.1 Fire Alarm Control Panel (FACP)

The Main Control Panel for the Fire Detection & Alarm system shall be of low voltage, solid state, and modular design with integral static protection. The Main Control Panel shall have LCD/LED display.

The Main Control Panel shall be Installer friendly & equipped with indicating lines plug in addressing system.

The Fire Detection & Alarm system shall be capable to monitor up to a appropriate quantity of addressable devices with the provision of future installation on each loop.

Each detector & manual call point shall be constantly supervised for ground, open circuits and short circuits. It shall be possible to individually program the input modules by internal switching or software programs to:

- Initiate an alarm instantaneously
- Disregard an alarm if the detector resets within 5 Seconds and is

not actuated again within 30 seconds

The Main Control Panel shall have on site programming facility. The user & service menus shall be password protected.

The Fire Detection & Alarm Control Panel shall be housed in a semi flush mounted cabinet with a lockable cover. All indications shall be visible from the locked cover. The controls shall be accessed from an access door on the cover.

The common alarm output shall be activated whenever there is an alarm on any line. Common trouble output shall be activated if any open circuit is detected on any alarm line and the tamper alarm shall be activated by removal of the front cover of the panel.

The Fire Detection and Alarm Control Panel shall provide the following functions/features:

- Indicate the actuation of fire detectors

- Supervise all alarm initiating and indicating lines for open circuit, short circuit & ground faults.

- Provide visual and audible indication in case of alarm or fault condition.

- Indications of power 'ON', power failure, ground fault & low battery etc.

- Power supply shall be a part of the panel and shall be of sufficient size to power all modules in panel and devices connected to the panel. It shall also have the capacity to recharge completely discharged back up batteries within eight hours and during normal operation, keeping the back up batteries fully charged by trickle charging. Input to the power supply shall be 230 Volt AC.

- Back up batteries shall be of sufficient size to keep the panel fully operational in case of power failure for minimum 24 hours. This time shall include 15 minutes of general alarm.

- Normally, in case of alarm on any line, only the alarm device shall be activated. If required it shall be possible to activate the general alarm from the panel.

- In case of alarm, it shall be possible to silence the alarm or activate

general alarm device from the panel. The alarm indication shall however remain on the panel until the alarm initiating device and the panel is brought back to normal operating conditions. Silencing of an alarm shall not prevent resounding of the audible alarm devices in case of a subsequent alarm on some other line.

Fire detection and alarm control panel shall comply to BS EN 54/NFPA 72.

4.2 Photo Electric Smoke Detector (SD)

All automatic fire detectors shall;

- be suitable for mounting on false ceiling or RCC ceiling surface
- have visual alarm indicator with a 360^{o} field of view
- have provision for remote alarm indicator
- be self resetting
- have strong weather resistant casing

Removal of the detector from its base shall cause a trouble indication on the display system. All detectors shall be equipped with an integral alarm indicator. The smoke detectors shall incorporate screens to minimize effects of small insects.

Wherever the remote alarm is connected the integral indication shall remain active.

The smoke detectors shall incorporate an LED, clearly visible from the outside, to provide indication of alarm activation or healthiness.

The detectors shall have adjustable sensitivity.

Photo Electric Smoke Detector (SD) shall comply to BS EN 54/NFPA 72

4.3 Fixed Temperature/Rate of Rise Heat Detector (HD)

The addressable fixed temperature/rate of rise heat detector shall be low voltage, comprising electronic evaluation circuit with twin thermistor differential temperature sensing.

Removal of the detector from its base shall cause a trouble indication on the display system. All detectors shall be equipped with an integral alarm

indication. Whenever the remote alarm is connected the integral indication shall remain active.

Fixed Temperature/Rate of Rise Heat Detector (HD) shall comply to BS EN 54/NFPA 72.

4.4 Manual Call Point/Station

The addressable manual call station shall be break glass type suitable for surface mounting. An auxiliary Normally Open (NO) contact shall be provided. The glass shall be resettable.

Manual Call Point/Station shall comply to BS EN 54/NFPA 72.

4.5 Sounder with Flasher/Visual

The addressable sounder with flasher shall be surface mounting type. Visual alarm signal shall have a high intensity flashing light; the electronic light shall be protected by long lasting over a wide range of weather conditions and environments lens.

Sounder with Flasher/Visual shall comply to BS EN 54/NFPA 72.

4.6 Power & Communication/Data Control Wires/Cables

The cables for the fire detection & alarm system shall be of Copper conductor cables and outer sheet material with fire/flame resistant characteristics.

All wires and cables shall be color-coded, tagged and checked for open, short or ground faults. No transposition of colors will be permitted. All wiring in terminal cabinets shall be made on terminal blocks of proper size and type for the services involved.

Cable joints shall only be allowed on the detector bases or junction boxes.

The cable size shall be not less than 1.5 mm^2. The system shall be of the two wire type.

Power & Communication/Data Control Wires/Cables shall comply to BS 7629, BS 5839, BS 6387, BS EN 60332, BS EN 50267, BS EN 61034 or equivalent IEC standards as applicable.

The wiring International testing certifications shall also be provided.

The Contractor shall provide and install the system in accordance with

applicable standards and manufacturer's recommendations. The wiring shall be in a conduit/ducting system, separated from other building wiring and other discipline/services.

The samples from the cable drums/coils supplied at site shall be taken and collected by the contractor in the presence of Client/consultant representatives for testing of same from UET or PCSIR Lahore in line with applicable standards / codes and test report of the same shall be submitted accordingly.

4.7 G.I/PVC Conduits/Ducts

The electrical conduits/ducts shall be manufactured as per latest version of relevant BS, IEC, ASTM etc. or equivalent standard specifications as recommended by the system specialist/installer. The PVC or steel/galvanized conduits/ducts shall be used for indoor wiring installation of fire alarm system as per site installation requirements.

4.8 Battery

Unless otherwise specified in the Project Documentation, the battery shall be of sealed lead acid maintenance free type as per IEC 60896 standard and sized for 24 hours backup. The battery set shall be installed in similar cabinet finish as the control panel.

5.0 INSTALLATION

The installation of Fire Detection and Alarm System shall be in strict accordance with the manufacturer's instructions/recommendations and these specifications.

6.0 TESTING

The testing of Fire Detection and Alarm System equipment shall be in strict compliance with the latest version of the relevant standards and regulations. During testing of equipment, emphasis shall be laid on the following points:

a. Operational Safety

b. Regular functioning of the system and devices

c. Protection against false alarms.

d. Various detectors like smoke, heat, etc. shall be subjected to the basic tests and sensitivity tests. The detectors shall be tested in various ways to check real and false alarm behaviors.

e. The control panels shall be subjected to the following tests:

i. Power failure test

ii. Battery failure test

iii. Real alarm and real trouble test

iv. Ground Fault test

v. Zone wise and general alarm test

vi. Lamp test (only for alarm lamps/LED'S)

vii. Field modifiable programming test

viii. Function test

7.0 TRAINING

A training session shall be presented by a fully qualified, trained representative of the equipment manufacture/supplier who is thoroughly knowledgeable of the specific installation. The training shall be given to personnel responsible for operation and maintenance of the Fire Detection and Alarm system.

The training session shall include but not limited to the following:

- Detailed explanation of wall charts as mentioned in Article 2.0 of this section
- Function of each control switch.
- Periodic operational testing of panel/devices
- Maintenance of fire log book supplied by manufacturer
- Actions to be taken upon receiving following signals
  - False alarm indication
  - Trouble on any initiating or indicating zone
  - Common alarm or common trouble indication
  - Low battery voltage indication

- Field modifiable programming

- How to perform periodic testing of panel and devices

8.0 WARRANTY AND MAINTENANCE SERVICES

The Bidder/authorized agent shall not only be responsible for five (05) years of warranty from the date of handing/taking over by the Engineer but also during the warranty period maintenance of the system including replacements of any/all defective components/parts against manufacturing defects with the genuine products/components through the manufacturer/authorized agents. Cost for the same shall deem to be included in the quoted price.

The involvement of the manufacturer/authorized agent for maintenance/replacement of components is considered important because the warranty of the manufacturer becomes void if genuine product/manufacturer recommended methodology/components installation is not followed. In addition to this it is also necessary that genuine branded products those offered at the time of supply with the system are provided for the 5 years of warranty/ component replacement period.

Undertaking in this regard shall be submitted by the Bidder as well as manufacturer/authorized agent.

Further, if required, the manufacturer/authorized agent through Bidder shall provide the proof of genuineness from the manufacturer for various components provided/installed in the system after fulfilling the technical requirements

The Bidder shall also be held liable for any cost of dismantling or re-erection which may have to be undertaken in order to replace defective parts.

9.0 MEASUREMENT AND PAYMENT

General

The Contractor's bid amount against each schedule of price item as given below shall include supply, installation, testing, commissioning and completion of all work specified herein and/or as shown on the Drawing related to the item.

9.1 Fire Alarm Control Panel

9.1.1 Measurement

Measurement shall be made as complete unit for including all related equipment such as power supply, relays, batteries, etc. alongwith all accessories acceptably supplied and installed by the

Contractor as a complete unit.

9.1.2 Payment

Payment shall be made for the complete unit measured, as provided alone, at the contract unit price and shall constitute full compensation for supplying, installing, testing and commissioning along with all accessories.

9.2 Photo Electric Smoke Detectors

9.2.1 Measurement

Measurement shall be made for the number of unit acceptably supplied and installed by the Contractor as complete unit.

9.2.2 Payment

Payment shall be made for the number of units measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing, testing and commissioning of complete unit including all required accessories.

9.3 Fixed Temperature/Rate of Rise Heat Detectors

9.3.1 Measurement

Measurement shall be made for the number of unit acceptably supplied and installed by the Contractor as complete unit.

9.3.2 Payment

Payment shall be made for the number of unit measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing, testing and commissioning of complete unit including all required accessories.

9.4 Addressable Call Point/Station

9.4.1 Measurement

Measurement shall be made for the total number of units acceptably supplied and installed by the Contractor as complete unit.

9.4.2 Payment

Payment shall be made for the total number of unit measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing, testing and commissioning of the complete unit including all required accessories.

9.5 Sounder with Flasher/Visual

9.5.1 Measurement

Measurement shall be made for the total number of units acceptably supplied and installed by the Contractor as complete unit.

9.5.2 Payment

Payment shall be made for the total number of unit measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing, testing and commissioning of the complete unit including all required accessories.

9.6 Wire & Cables

9.6.1 Measurement

Measurement shall be made of the total number of running meters for each type and size of cable acceptably supplied and installed by the Contractor.

9.6.2 Payment

Payment shall be made for the total number of running meters of each type and size of cable at the Contract unit price. The payment shall constitute full compensation for supply, installing, testing and commissioning of the required cables including all accessories.

9.7 PVC Ducts

9.7.1 Measurement

Measurement shall be made for the number of unit acceptably supplied and installed by the Contractor.

9.7.2 Payment

Payment shall be made for the total number of unit measured as provided above at the Contract unit price. The payment shall constitute full compensation for supplying and installing of the PVC ducts on surface roof, walls, columns, including all mounting and/or installation materials and accessories.

9.8 G.I Conduits

9.8.1 Measurement

Measurement shall be made for the number of unit acceptably supplied and installed by the Contractor.

9.8.2 Payment

Payment shall be made for the number of unit measured as provided above at the Contract unit price. The payment shall constitute full compensation for supplying and installing of the G.I conduits on surface roof, walls, columns, floor or slabs including all mounting and/or installation materials and accessories.

9.9 Graphic user Interface (GUI) Software

9.9.1 Measurement

Measurement shall be made for the number of unit as specified acceptably supplied by the Contractor.

9.9.2 Payment

Payment shall be made for the number of unit measured as provided above at the Contract unit price. The payment shall constitute full compensation for supplying as a complete unit.

9.10 Computer

9.10.1 Measurement

Measurement shall be made for the number of unit as specified acceptably supplied by the Contractor.

9.10.2 Payment

Payment shall be made for the number of unit measured as

provided above at the Contract unit price. The payment shall constitute full compensation for supplying as a complete unit.

9.11 Maintenance Services

9.11.1 Measurement

As stipulated in Contract document

9.11.2 Payment

As stipulated in Contract document

SECTION – 8372
10. LOCAL AREA NETWORK

1 SCOPE

The work under this section consists of supplying, installing, configuring, programming, testing, commissioning, and training of all material and services of the complete Local Area Network System. The system shall be complete in all respect as described in these specifications, drawings, B.O.Q and in accordance with International Organization for Standardization (ISO) and Telecommunications Industry Association (TIA) recommendations.

The Contractor shall discuss the cabling layout with the Engineer and co-ordinateat site for exact locations and positions of the LAN equipment and routing of cables etc.

The preparation of shop/As Built drawings and low level design is the responsibility of the Contractor. This specification and description is intended to set out the minimum requirements and it is expressly understood and agreed by the Contractor that anything which is usually furnished as a part of such installation as is called for in this tender and which is necessary for its proper completion, execution and function shall be furnished as a part of this specification without additional costs and extension of time whether or not shownin details on the drawings or described in particular hereinafter.

The technical documentation to be furnished by the Contractor shall include installation, testing & configuration plans, shop drawings, material/equipment submittals, as-built drawings, etc. as necessary for complete installation in light ofthe tender documents.

2 SYSTEM REQUIREMENTS

2.1 GENERAL

The Local Area Network (LAN) shall be established to provide network servicesto users. Keeping in view the importance of efficient and effective communication System, a state-of-the-art computer network shall be designed for Main Building of Sindh Forensic Science Laboratory. The network shall be scalable to cater for the future needs and capable of absorbing various IP based Applications.

2.2 NETWORK INFRASTRUCTURE

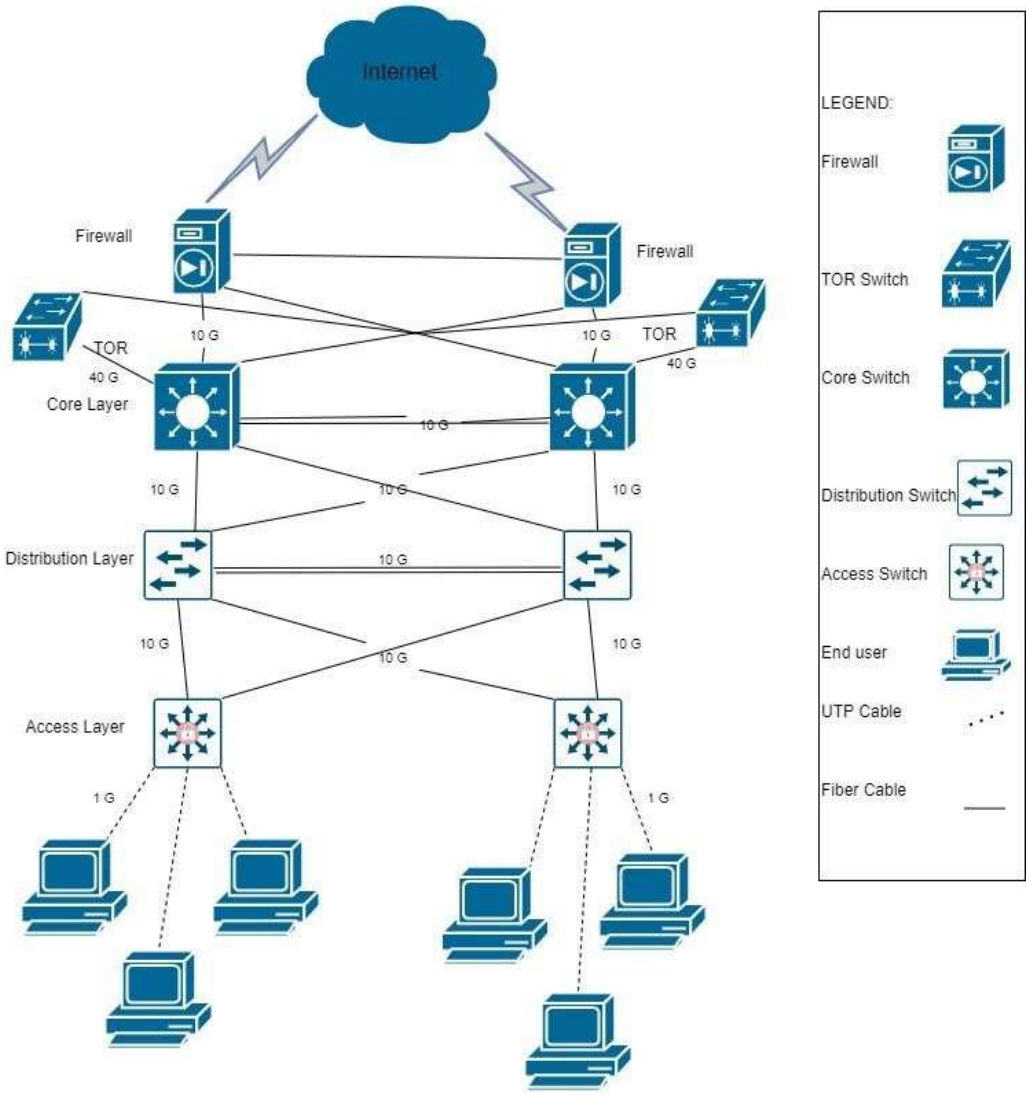
The LAN shall be based on hierarchical switching architecture that includes Core,Distribution and Access layers. The Core layer which is Network's backbone will be implemented by means of two layer 3 Switches which shall be placed in the Data Center located at ground floor of the Main Building.

Distribution layer shall be implemented by means of two layer 3 switches which will be connected to the Core Switches. As the proposed network is divided into two zones so one Distribution Switch shall be placed in Zone A and otherDistribution Switch shall be placed in Zone B. Distribution Switch placed in ZoneA shall be placed in the Data center whereas Distribution Switch placed in ZoneB shall be placed in the Processing laboratory located in Ground floor.

Distribution Switches shall be connected to Core Switches on Single Mode Fiber Optics to provide multi-gigabit connectivity. Both Distribution Switches shall be stacked by configuring in a way to act as a single switch and act cooperatively.

Distribution layer will act as a services and control boundary between the Access and Core layer. It will be an aggregation point for all Access switches and will act as integral member of Access Distribution block providing connectivity and policy services for traffic flows within the Access Distribution block. It will take the traffic coming up from Access layer and move it to Core layer.

The user access shall be provided through category 6A Unshielded Twisted Pair (UTP) cable. The logical diagram of the LAN is shown below.



The Access layer shall grant end devices access to the network. These devices which include Computers, Laptops, and Printers etc. will be connected withEthernet switches at Access layer shall make forwarding decision based on MACaddress information.

Virtual Local Area Network (VLAN) will be configured to separate the network broadcast traffic between different departments/ offices. As VLAN are implemented, traffic between different departments/offices will also be isolated. Inter VLAN Routing will be enabled so that authorized user of one VLAN may access services of other VLAN.

2.3 SWITCHING EQUIPMENT

The core layer shall be implemented by means of a layer 3 switch which shall provide high speed switching and routing services. The Distribution layer shall beimplemented by Distribution Switches which shall be fixed configuration manageable Layer-3 switches. 10G port shall be used to connect distribution switches with Core Switches.

Access layer shall be realized by means of fixed configuration manageable layer 2 10/100/1000 mbps switches to provide connectivity to Workstations/network users. The Access switches shall be installed in different areas of the buildings which will be connected to the Distribution switches through single mode fiber optics to provide multi-gigabit connectivity. All the switching equipment will be provided power through UPS.

2.4 LAN CABLING

Building backbone cabling shall be realized by means of single mode fiber optics.The fiber infrastructure shall have necessary redundancy for future use and the cable installation shall be according to industry standards.

The horizontal cabling shall be Category 6A or higher Unshielded Twisted Pair (UTP) 4 pair cable providing secure, reliable and high-speed data communicationand information sharing mechanism. The cable employed shall have excellent electrical characteristics and shall have slim design. All the cables within the coverage zone of a specific switch shall converge to a data cabinet, typically installed on the wall. Proper cabling inside the cabinet shall be done by using cable managers, cable ties etc. Data Cabinet shall be secured from unauthorizedaccess.

Face Plates with Dual shutters and Single shutters with Dual & Single I/O RJ-45 shall be installed at different locations.

The fiber cabling shall be installed to cater for future expansion. Proper concealment shall be done to provide protection against rodents and to preserve the architectural beauty of the building.

The branded passive equipment including UTP cable, Fiber Optics, Face Plates, Patch Panels, Patch Cord and Information outlets (I/Os) shall conform to Cat 6A standard. The cabling infrastructure (fiber & UTP) shall provide 20 years warrantyfrom principal cable manufacturer.

The switching and cabling infrastructure for Access Control System will be

part ofthis Local Area Network system.

All the passive equipment shall be labeled as per industry standards for efficiently managing the cabling infrastructure.

The lockable glass door data cabinets/racks of adequate size for network switches, UPS and patch panels shall be installed. Fans shall be installed in the cabinets to make the cabinets cool and airy. Required electrical outlets power shall be available in the data cabinets/racks.

3 ACTIVE & PASSIVE COMPONENT DETAIL

3.1 CORE SWITCH

Two Stackable fixed configuration manageable Layer 3 Switches with Switching capacity of 1.92 Tbit/sec or higher, Optical interface: 24SFP Plus+ ports, 4QSFP Plus ports, (Optical interface 10GE ports, 40GE ports, and 100GE ports card are supported), dual power supply, power cable, hot swappable redundant fans , Multi-layer switching and enhanced routing capability, Support of RIP, OSPF, DHCP snooping, Support ARP entries of 140K minimum, Support multicast traffic, Software based fault tolerance, Minimum 200K MAC addresses entries, QoS and Filtering, Multi-layer switching and enhanced routing capability, Support multiple VLANs, Security features: 802.1x, Access Control Lists (ACLs), SNMP enabled, remote monitoring, Telnet support, Web based management interface with complete installation, configuration, testing and minimum one yearcomprehensive warranty shall be installed in the Data Center located in ground floor of the Main Building.

3.2 DISTRIBUTION SWITCH

Two Stackable fixed configuration manageable Layer 3 Switches having switching capacity of 680 Gbps or higher, 26 x 10 Gig SFP plus Ports, 2 x 40G QSFP Ports, 1 slot for future expansion, support 802.1X authentication, Multilayer Quality of Service (QoS), support multicast traffic, minimum 200K MAC addresses entries, Support minimum 140K ARP entries, support multiple VLANs, ACL, Redundant power supplies hot swappable, Redundant fans, Power cable, SNMP enabled, Web based management interface, NAT, telnet with complete installation, configuration,testing and minimum one year comprehensive warranty shall be installed in the Main Building. Both Switches shall be connected to Core switches on 10G connectivity.

Distribution Switch lying in Zone A shall be placed in the Data Center whereas Distribution Center lying in Zone B shall be placed in Processing

Lab at the Ground Floor. Data traffic coming from Access Switches installed in Evidence Block and Reception Block shall be terminated in both Distribution Switches.

3.3 TOR SWITCH

Two Fixed configuration manageable Data Centre switches with 48 x 25 Gbps SFP Ports, 4 x 40 Gbps QSFP uplink port, redundant power supply and fans, power supply, SNMP enabled, Supports Bidirectional Forwarding Detection (BFD) with a detection interval of 1ms or higher, Web based management interface with completeinstallation, configuration, testing and minimum one-year comprehensive warranty shall be installed in the Data Center.

3.4 48 PORT ACCESS SWITCH

Fixed configuration manageable layer 2 switches with 48 x 10/100/1000Base T Ports, 4 x 10 GE SFP ports for SFP based uplink connectivity over fiber optics, forwarding speed: 132 Mpps, switching capacity 176 Gbps or higher, 2 GB RAM, support 802.1X authentication, MAC address authentication, support multiple VLANs, ACL, with complete installation, testing and minimum one-year comprehensive warranty. Warranty Period shall start after signing of Handing Over/Taking Over Certificate.

3.5 24 PORT ACCESS SWITCH

Fixed configuration manageable layer-2 switch, 24 x 10/100/1000Base T Ports, 4 x 10 GE SFP ports for SFP based uplink connectivity over fiber optics, forwarding speed: 96 Mpps, switching capacity 128 Gbps, 2 GB RAM, support 802.1X authentication, MAC address authentication, support multiple VLANs, ACL, with complete installation, testing and minimum one-year comprehensive warranty. Warranty Period shall start after signing of Handing Over/Taking Over Certificate.

3.6 FIRE WALL

Two Next generation Firewalls with the throughput of 15 Gbps or higher with SFP and RJ45 port, dual redundant power supply, USB operator or console port, capable of web filtering, application control, IPs, URL filtering, anti Spam, anti-malware, Must Have Full Features Working Even License Is Expired, Must Have Minimum 3.6Gbps NGFW Throughput IMIX (FW + SA + IPS), Must Have Minimum 4Gbps Threat Protection Throughput (FW + SA + IPS + Antivirus), IPsec VPN throughput ≥ 15 Gbit/s, Must Have Unrestricted Concurrent User, Must Have Minimum 1TB Storage Capacity,

Must Have Minimum 6 x 1G Ethernet Interfaces & 4x10G SFP+ Interfaces, Must Include Intrusion Prevention System (IPS), Anti-Virus & Anti-Malware, Email Security Protection, Cloud-Based Security Sandbox, Web Filtering, Application Control, Bandwidth Management, Policy-based routing, RIP, OSPF, BGP, and IS-IS, Minimum 100 Concurrent Users for SSL VPN with 3 Year Complete Security Features License and 3 Year Software Upgrade.

3.7 SINGLE MODE FIBER OPTICS CABLE

24 core Fiber Cable single Mode with Steel Tape Armored Cable with Complete installation, testing and minimum 20 years comprehensive warranty and complete in all aspects. Fiber Optic Cable Fusion Splicing Single Mode with Complete installation and Complete in all aspects. SFP modules (40G, 25G, 10F, 1G) will be provided as per the proposed plan.

3.8 UTP CABLE CAT 6A

The user access will be provided through structured category 6A or higher Unshielded Twisted Pair (UTP) cable which will provide secure, reliable and high-speed data communication and information sharing mechanism. All the cables within the coverage zone of a specific switch will converge to a data cabinet. In addition to Access Switch, this cabinet shall house UTP Patch Panel, Fiber PatchPanel and UPS. Proper cabling inside the cabinet will be done by using cable managers, cable ties etc. Data Cabinets will be secured from unauthorized access by providing lock and key. Data and power cables shall be installed in separate cable trays/PVC conduits. Proper labeling of passive equipment shall also be done to facilitate network management. Stack cables will be provided for the stacking. Faceplate shattered (duplex and simplex) along with all required equipment (I/O and backbox) will be provided as per the provided plan.

The LAN cable also provide the network access to Multimedia Projector, Employee Attendance System and Video Conferencing System.

The switching and cabling infrastructure for Access Control System will be part ofthis Local Area Network system.

Main Building

Sr. No	Location	No. of Location	Estimated No. of Network Nodes per Location	Total No. of Estimated Network Nodes
Basement Floor				
Zone-A (West Side)				
1.	Mechanical Room	04	01	04
2.	Trace Screen	01	01	01
3.	Photography for V.E.T	01	01	01
4.	Inventory Store	01	01	01
5.	AHU room	01	01	01
6.	Electrical room	01	01	01
7.	Command and Control Room (CCTV Room)	01	10	10
			Total	**19**
Basement Floor				
Zone-B (East Side)				
1.	Shooting Range	01	01	01
2.	Electrical Room	01	01	01
3.	Lt Panel Room	01	01	01
4.	Ammunition Room	01	01	01
5.	Staff locker Room			
6.	Tool marks Shop	01	01	01
7.	Gun Store	01	01	01
8.	Projectile Recovery room	01	01	01
9.	Bio Hazardous Storage	02	01	02
			Total	**09**
Ground Floor				
Zone-A (West Side)				
1.	DG Room	01	02	02
2.	Director Room	02	01	02
3.	Meeting Room	02	01	02
4.	Waiting Area	01	01	01
5.	PA Room	01	01	01

6.	Retiring Room	01	01	01
7.	Deputy Director Room	06	01	06
8.	Staff Room	02	01	02
9.	Assistant Director Room	13	01	13
10.	Law Officer Room	04	01	04
11.	IT Data Center & Workstation	01	12	12
12.	Region Hall	01	01	01
13.	L.C Room	03	01	03
14.	AHU Room	01	01	01
15.	Electrical Room	01	01	01
16.	Supervisor	02	01	02
17.	Support Staff	01	01	01
18.	Account & Finance	03	01	03
19.	Admin	03	01	03
20.	IT Manager	01	02	02
21.	Office	01	02	02
22.	Conference Room	01	03	03
23.	Entrance lobby	02	01	02
24.	Entrance lobby near Conference	01	01	01
			Total	**71**
Ground Floor				
Zone-B (East Side)				
1.	Workstation	01	16	16
2.	Evidence Processing Lab with ALS	01	01	01
3.	Gun Collection Vault	01	01	01
4.	Gun Shot Residue	01	01	01
5.	Record RM			
6.	Supervisor, (CSI, FTM)	02	01	02
7.	Microscopy FTM, RM	07	01	07
8.	Polygraph Lab-1	03	01	03
9.	Supervisor Polygraph & Waiting Area	02	01	02

10.	Workstation near Polygraph	01	06	06
11.	Workstation LFP			
12.	Consumable Storage	01	01	01
13.	Record Room			
14.	Processing Lab	01	02	02
15.	ALS	01	01	01
16.	AFIS	10	01	10
17.	Electrical	01	01	01
18.	AHU Room	01	01	01
19.	Entrance Lobby	01	01	01
20.	Record (FTM)	01	01	01
21.	Processing Lab Gun Workshop	01	02	02
22.	Stocks Evidence Store	01	01	01
23.	IBS integrated ballistic information system	08	01	08
24.	Evidence Draying RM			
25.	Storage CSI	01	01	01
26.	FTM Analyst Cabin 1	01	25	25
27.	FTM Analyst Cabin 2	01	13	13
28.	Workstation CSI	01	13	13
29.	Laser RM	01	01	01
30.	Vault	01	01	01
31.	Supervisor	03	01	03
			Total	**125**
First Floor				
Zone-A (West Side)				
1.	DNA Reference Evidence Extraction Room	01	02	02
2.	DNA Evidence Extraction Room	01	02	02
3.	Library Conference	01	02	02
4.	Pre-Pcr	02	02	04
5.	DNA Analytical Room	02	02	04
6.	Supervisor office	01	02	02
7.	Evidence Vault	01	01	01
8.	Preference Vault	01	01	01
9.	DNA Stock Store	01	01	01

10.	DNA Workstation- 01	01	36	36
11.	AHU Room	01	01	01
12.	DNA Data Base	01	02	02
13.	Electrical	01	01	01
14.	Serology Lab-01 to 05	05	01	01
15.	DNA Workstation-02	01	35	35
16.	DNA QA RM	01	01	01
			Total	**96**
First Floor				
Zone-B (East Side)				
1.	Extraction	01	02	02
2.	Instrumentation Lab	01	02	02
3.	Microscopy Lab	01	02	02
4.	Standard Room	01	01	01
5.	Evidence Vault	01	01	01
6.	Record Room	01	01	01
7.	Workstation (1,2) NAR	01	29	29
8.	Record Room	01	01	01
9.	Trace Workstation	01	13	13
10.	Lab FTIR Microscopy	01	02	02
11.	Evidence Liquor Trace Sampling	01	01	01
12.	Trace Evidence Vault	01	01	01
13.	AHU Room	01	01	01
14.	Electrical Room	01	01	01
15.	Explosive lab	01	01	01
16.	Stock Trace			
17.	Solvent RM NAR	01	01	01
18.	NAR Supervisor	01	01	01
19.	Spectroscopy lab	01	08	08
20.	Supervisor Trace	01	01	01
21.	Instrumentation RM	01	03	03
22.	Solvent RM Trace	01	01	01
			Total	**74**
Second Floor				
Zone-A (West Side)				
1.	QD Lab 1	01	01	01
2.	QD Lab 2	01	01	01
3.	Record			
4.	(QD) Analytic RM	01	01	01

5.	Computer Forensic Workstation & Maintenance	02	13	26
1.	Forensic Photography Work Station	01	05	05
2.	Com Forensic Supervisor	01	01	01
3.	Audio/Video Supervisor	01	01	01
4.	F Photo Studio	01	01	01
5.	F Photo Digital imaging	01	01	01
6.	F.P Sup.	01	01	01
7.	Record Pathology	01	07	07
8.	X-Ray	01	01	01
9.	Model Making	01	01	01
10.	Dissection	01	01	01
11.	Brain Dissection	01	01	01
12.	Autopsy Hall	01	02	01
13.	Evidence Vault	01	01	01
14.	Microscopy Room	01	01	01
15.	Histology Lab 2	01	02	02
16.	AHU Room	01	01	01
17.	Electrical Room	01	01	01
18.	Pathologist	01	01	01
19.	Workstation 21 Person	01	21	21
20.	SH-CH	01	02	02
21.	Recording RM	01	01	01
22.	Dark Room	01	01	01
23.	Audio Forensic RM	01	02	01
24.	QD Chemical Processing RM	01	01	01
25.	Supervisor QD	01	01	01
26.	Video Forensic Workstation	01	05	05
27.	Audio/Video Photography Comparison RM	01	06	06
28.	AV Record, CF Record and QD Record	03	01	03

29.	QD Workstation	01	11	11
			Total	**111**
Second Floor				
Zone-B (East Side)				
1.	Conference Room	01	02	02
2.	Quality Assurance	03	01	03
3.	Library	01	01	01
4.	Record RM	01	01	01
5.	Standard RM	01	01	01
6.	Janitorial Closet			
7.	Supervisor Toxicology	01	01	01
8.	Toxicology Instrumentation	01	01	01
9.	Toxicology Workstation	01	28	28
10.	Toxicology Sampling	01	01	01
11.	AHU Room	01	01	01
12.	Electrical Room	01	02	02
13.	General Storage	01	01	01
14.	Instrument Supply RM	01	01	01
15.	Solvent RM	01	02	02
16.	Toxicology instrument RM	01	03	03
17.	Toxicology Extraction	01	02	02
			Total	**51**
Third Floor				
Zone-A (West Side)				
1.	DNA	01	02	02
2.	Toxicology	02	01	02
3.	Trace Chemistry	01	01	01
4.	Pathology	01	02	02
5.	Audio, Video	01	02	02
6.	Computer Forensic	01	02	02
7.	Crime Scene	01	01	01
8.	Question Documentation	01	01	01
9.	Narcotics	01	02	02
10.	Firearm Tool M	01	01	01
11.	AHU Room	01	01	01

12.	Electrical Room	01	01	01
			Total	**18**
Third Floor				
Zone-B (East Side)				
1.	Mock Training Area	01	06	06
	Mock Training Area	01	02	02
2.	Class Room	04	02	08
3.	Tea Area	01	01	01
4.	AHU Room	01	01	01
5.	Electrical Room	01	01	01
6.	Dining Area	01	01	01
7.	Trainer Room	02	01	02
			Total	**22**
Fourth Floor				
1.	AHU Room	02	01	02
2.	Electrical Room	02	01	02
3.	Refreshment	01	01	01
4.	Auditorium Room	02	01	02
5.	Auditorium Stage	01	03	03
			Total	**10**
Fifth Floor				
1.	Elevators	05	01	05
2.	AHU	02	01	02
3.	Electrical	02	01	02
4.	Refreshment	01	01	01
			Total	**10**
Roof Floor				
1.	Roof Elevator	01	01	01
2.	Machine Room	01	02	02
			Total	**03**
			Total	**619**

4 APPLICABLE STANDARDS AND CODES

The latest editions of the following standards/codes shall be applicable for thematerials covered within the scope of this section:

TIA/EIA 568-B.1, B.2, B.3:	Telecommunications Cabling Standard
TIA/EIA 569-A:	Commercial Pathways and Spaces
TIA/EIA 606:	Standard for Telecom Infrastructure
ISO/IEC 11801:	Generic Cabling for Customer Premises

5 DRAWINGS (SHOP, AS-BUILT)

The contractor shall prepare shop drawings to indicate location of IT equipment, cable routes etc. keeping in view the actual site conditions and submit for approval prior to start of cable laying process. As-built drawings shall be prepared by the Contractor after the successful testing of the cabling infrastructure.

6 INSTALLATION REQUIREMENTS

Installation of all equipment shall require close coordination between the contractor and the Client personnel. The data cabinet sizing, its exact location & power supply scheme shall be submitted for Consultant/Engineer Incharge's approval. The contractor shall ensure that the cabling and crimping/termination of installed equipment shall be done in accordance with the industry standards and supported by the Original Equipment Manufacturer (OEM).

7 TESTING & COMMISSIONING

The contractor shall make necessary arrangement including tools, access etc for scheduled site inspections. Fluke testing of UTP & fiber links shall be conducted by the Contractor as per the approved test/commission plan by the Consultant/Engineer Incharge. The reports shall be submitted to the Client after successful completion of testing/commissioning phase.

All the active equipment shall be tested & commissioned by the Contractor as per the approved test/commission plan by the Consultant/Engineer Incharge.

8 TRAINING

The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant. However, two levels of training shall be imparted; user level and administrative/advanced level.

9 DOCUMENTATION

The contractor shall provide technical documentation that includes all layouts, complete labeling scheme, workshop/ shop drawings, network addressing scheme, active equipment configuration detail, as-built drawings, etc. which are necessary for complete installation in light of the tender documents. All user manuals shall also be submitted.

10 WARRANTY & MANAGED SERVICES

The Contractor shall provide comprehensive one-year on-site warranty and managed services of all active equipment. During this period, it will be the responsibility of the Contractor to rectify any defects and provide services such as preventive maintenance, configuration of equipment, problem rectification within the permissible downtime and backup equipment inventory. The necessary patches, upgrades and updates as and when released by the original supplier shall also be provided during the warranty period so as to ensure that the system is functioning to provide the best performance. Warrantyperiod shall be started after signing of Handing Over/Taking Over Certificate.

The Contractor shall provide 20 years warranty for the LAN cablinginfrastructure.

11. INTERNET BANDWIDTH

1 SCOPE

The work under this section consists of supplying, installing, configuring and commissioning of Internet for Sindh Forensic Science Laboratory. The system shall be complete in all respect as described in below specifications.

The Contractor shall discuss the cabling layout with the Engineer and co-ordinate at site for exact locations and positions of the ISP equipment and routing of fiber cables etc to be terminated in the Data Center at Ground Floor.

The preparation of shop/As Built drawings and low level design is the responsibility of the Contractor. This specification and description is intended to set out the minimum requirements and it is expressly understood and agreed by the Contractor that anything which is usually furnished as a part of such installation as is called for in this tender and which is necessary for its proper completion, execution and function shallbe furnished as a part of this specification without additional costs and extension of time whether or not shown in details on the drawings or described in particular hereinafter.

The technical documentation to be furnished by the Contractor shall include installation, testing & configuration plans, shop drawings, material/equipment submittals, as-built drawings, etc. as necessary for complete installation in light of the tender documents.

2 SYSTEM REQUIREMENTS

2.1 GENERAL

The Internet Bandwidth shall be provided. Dedicated bandwidth shall be allocated for the replication of data from Primary Site to Disaster Recovery Site of the Sindh Forensic Laboratory. Moreover, restricted and policy-based internet will also be provided to the end users of the Sindh Forensic Laboratory.

3 INTERNET BANDWIDTH DETAIL

3.1 TERMINATION OF INTERNET AT DATA CENTER

It shall be the responsibility of the contractor to terminate the internet fiber cable at the room where the Firewall and Network core switches will be installed. The Contractor shall discuss the cabling layout with the site engineer. The ISP equipment shall be properly installed in Rack and dressing of cables shall be responsibility of the Contractor.

3.2 CIR BANDWIDTH WITH STATIC IP POOL

Committed Information Rate (CIR) of initially **100 Mbps** with 06 usable static IP's shall be used.

3.3 REDUNDANT BANDWIDTH CHANNEL

It shall be the responsibility of the contractor to provide the backend different channel preferably Fiber and Wireless to avoid the link down issues.

4 INSTALLATION REQUIREMENTS

Installation of all equipment shall require close coordination between the contractor and the Client personnel. The data cabinet sizing, its exact location & power supply scheme shall be submitted for Consultant/Engineer Incharge's approval. The contractor shall ensure that the cabling and crimping/termination of installed equipment shall be done in accordance with the industry standards.

5 TESTING & COMMISSIONING

The contractor shall make necessary arrangement including tools, access etc for the bandwidth download and upload speed test. Bandwidth link test shall be conducted by the Contractor as per the approved test/commission plan by theConsultant/Engineer In charge. The reports shall be submitted to the Client after successful completion of testing/commissioning phase.

6 TRAINING

The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant.

7 DOCUMENTATION

The contractor shall provide technical documentation that includes all layouts, complete labeling scheme, workshop/ shop drawings, network addressing scheme, organization bandwidth usage monitoring graph link and credentials, active equipment configuration detail, as-built drawings, etc. which are necessary for complete installation in light of the tender documents. All user manuals shall also be submitted.

8 WARRANTY & MANAGED SERVICES

The Contractor shall be responsible for the internet termination equipment (fiber termination box, converters, routers, switches etc.) and will define Standard Procedure

Operations in case of any down time occurs. During this period, it will be the responsibility of the Contractor to rectify any defects and provide services such as preventive maintenance, configuration of equipment, problem rectification within the permissible downtime and backup equipment inventory. The necessary patches, upgrades and updates as and when released by the original supplier shall also be provided during the warranty period so as to ensure that the system is functioning to provide the best performance. Warranty period shall start from the signing date of Handing Over/ Taking Over Certificate.

SECTION – 8335

12. IP BASED CCTV SURVEILLANCE SYSTEM

1 SCOPE

The work under this section consists of supplying, installing, configuring, programming, testing, commissioning and training of all material and services of complete IP Based CCTV Surveillance System. The system shall be complete in all respect as described in these specifications, drawings, B.O.Q and in accordance with International Organization for Standardization (ISO) and Telecommunications Industry Association (TIA) recommendations.

The Contractor shall discuss the cabling layout with the Engineer and co-ordinate at site for exact locations and positions of the CCTV equipment and routing of cables etc.

The preparation of shop/As Built drawings and low-level design is the responsibility of the Contractor. This specification and description is intended to set out the minimum requirements and it is expressly understood and agreed by the Contractor that anything which is usually furnished as a part of such installation as is called for in this tender and which is necessary for its proper completion, execution and function shall be furnished as a part of this specification without additional costs and extension of time whether or not shown in details on the drawings or described in particular hereinafter.

The technical documentation to be furnished by the Contractor shall include installation, testing & configuration plans, shop drawings, material/equipment submittals, as-built drawings, etc. as necessary for complete installation in light of the tender documents.

2 SYSTEM REQUIREMENTS

2.1 GENERAL

An IP based Surveillance System with state-of-the-art technology shall be deployed at Main Building, Evidence Block, Reception Block, Boundary Wall, Internal Roads and Main Entry/Exit of Sindh Forensic Science Laboratory to provide high level of security and to record live footage of the cameras inside the buildings and its surroundings. All Corridors, Waiting Areas, Reception, Elevators, Stairs, Main Entry/Exit, Podium, Passages, Cycle/Motor Cycle Stand, Parking Area, boundary wall and inside roads shall be monitored and recorded by the System.

The indoor area of the building shall be covered by 4 Megapixels Fixed Dome Cameras with resolution (2560 × 1440) and the outside area shall be covered with 4 Megapixels PTZ with resolution (2560 × 1440), 4MP Fixed lens bullet with

resolution (2560 × 1440) and 4MP varifocal bullet cameras with resolution (2560 × 1440).

The building wise detail of CCTV network nodes is as follow:

Main Building

Sr. No	Location	No. of Location	No. of Cameras per location	Total No. of Cameras
Basement Floor				
Zone-A (West Side)				
24 Port PoE Switch				
1.	Corridor to Evidence Block	01	02	02
2.	V.E.T	01	02	02
3.	Stairs near Electrical Room	01	01	01
4.	Parking Drive Way	01	06	06
5.	Stairs near Lifts	02	01	02
			Total	**13**
Basement Floor				
Zone-B (East Side)				
24 Port PoE Switch				
1.	Corridor adjacent to walk in freezer	01	04	04
2.	Stairs near Electrical Room	01	01	01
3.	Parking Drive Way	01	05	05
4.	Stairs near Tool mark Shop	01	02	02
5.	Corridor Near Gun Store	01	01	01
			Total	**13**
Ground Floor				
Zone-A (West Side)				
48 Port PoE Switch				

1.	Corridor adjacent to	02	01	02
	Data Center			
2.	Stairs near Electrical Room	01	01	01
3.	Conference Room	02	01	02
4.	Stairs near Assistant Director Office	01	01	01
5.	Emergency Exit	02	01	02
6.	Corridor adjacent to Deputy Director office	01	01	01
7.	Corridor adjacent to Assistant Director office	03	01	03
8.	Corridor adjacent to Director office	02	01	02
9.	Corridor adjacent to Meeting room	01	01	01
10.	Main Entrance side	01	01	01
11.	Corridor adjacent to Conference room	03	01	03
12.	Main Entrance Lobby	01	01	01
13.	Podium Side	01	01	01
14.	AHU Room	01	01	01
15.	Data Center	04	01	04
16.	Waiting Area	01	01	01
			Total	**27**
Ground Floor				
Zone-B (East Side)				
48 Port PoE Switch				
1.	Entrance from Podium	01	01	01
2.	Sitting area near lift lobby	02	01	02
3.	AHU Room	01	01	01
4.	Main Entrance	01	01	01
5.	Corridor adjacent to Consumable Store	02	01	02

6.	Corridor adjacent to ALS room	01	01	01
7.	Corridor adjacent to AFIS	03	01	03
8.	Stairs near AHU Room	01	01	01
9.	Corridor adjacent to AFIS room	03	01	03
10.	Corridor adjacent to Evidence Processing Lab-2	01	01	01
11.	Stairs near record room	01	01	01
12.	Emergency Exit	02	01	02
13.	Polygraph Lab 1-3	03	01	03
14.	Evidence Processing Lab 2	01	01	01
15.	C.S Lab	01	01	01
16.	Processing Lab	01	01	01
17.	Corridor near Microscopy Room	01	01	01
			Total	**24**
First Floor				
Zone-A (West Side)				
24 Port PoE Switch				
1.	Stairs near Electrical Room	01	01	01
2.	Corridor adjacent to Electrical Room	03	01	03
3.	Corridor adjacent to DNA Screening room	02	01	02
4.	Corridor adjacent to Evidence Vault room	02	01	02
5.	Lift and Stairs Lobby	01	01	01
6.	Corridor adjacent to Supervisor office	02	01	02
7.	Stairs near Janitorial Supply room	01	01	01
8.	Corridor adjacent to	01	01	01

	DNA Analytic room			
9.	Corridor adjacent to Library Conference room	01	01	01
10	DNA Database	02	01	02
11	DNA Stock Store	01	01	01
12	Podium Side	01	01	01
13	Lift lobby	02	01	02
			Total	**20**
First Floor				
Zone-B (East Side)				
24 Port PoE Switch				
1.	Corridor near lift lobby	02	01	02
2.	Corridor adjacent to electrical room	03	01	03
3.	Podium Side	01	01	01
4.	Stairs near Electrical Room	01	01	01
5.	Corridor adjacent to Lab-5	01	01	01
6.	Corridor adjacent to record room	03	01	03
7.	Corridor adjacent to work station	02	01	02
8.	Stairs near work station	01	01	01
9.	Corridor adjacent to extraction room	01	01	01
10.	Microscopy Lab	01	01	01
11.	Lab 1-6	06	01	06
			Total	**22**
Second Floor				
Zone-A (West Side)				
20 Port PoE Switch				
1.	Stairs near Electrical Room	01	01	01
2.	Corridor adjacent to Electrical Room	03	01	03

3.	Corridor adjacent to Evidence Vault	02	01	02
	room			
4.	Stairs near supervisor room	01	01	01
5.	Corridor adjacent to Audio studio room	02	01	02
6.	Corridor adjacent to Computer Forensic Workshop	02	01	02
7.	Corridor adjacent to Lab-2 ESDA	02	01	02
8.	LAB VSC	01	01	01
9.	LAB ESDA	01	01	01
10.	Histology Lab	01	01	01
11.	Corridor adjacent to lifts	03	01	03
12.	Lifts lobby	01	01	01
			Total	**20**
Second Floor				
Zone-B (East Side)				
24 Port PoE Switch				
1.	Lobby adjacent to lifts	01	01	01
2.	Corridor adjacent to Lift Lobby	02	01	02
3.	Corridor adjacent to supervisor	02	01	02
4.	Stairs near Electrical Room	01	01	01
5.	Corridor adjacent to Toxicology sampling room	03	01	03
6.	Corridor adjacent to Toxicology workstations	02	01	02
7.	Stairs near spare room	01	01	01
8.	Corridor adjacent to quality assurance room	01	01	01

			Total	**14**
Third Floor				
one-A (West Side)				
24 Port PoE Switch				
1.	Stairs near Electrical room	01	01	01
2.	Corridor adjacent to FTM room	03	01	03
3.	Corridor adjacent to COM	02	01	02
4.	Lift near Electrical Room	01	01	01
5.	Narcotics	01	01	01
6.	Corridor adjacent to lifts	03	01	03
7.	Pathology	01	01	01
8.	Stairs near COM room	01	01	01
9.	TOX	02	01	02
10.	DNA	03	01	03
11.	Lift lobby	01	01	01
12.	Lifts in Lift Lobby	03	01	03
			Total	**22**
Third Floor				
Zone-B (East Side)				
24 Port PoE Switch				
13.	Stairs near Electrical room	01	01	01
14.	Corridor adjacent to dining room	03	01	03
15.	Corridor adjacent to mock training area	01	01	01
16.	Lift near Electrical Room	01	01	01
17.	Corridor adjacent to Class room	02	01	02
18.	Stairs near Class room	02	01	02
19.	Lift lobby	01	01	01

20.	Corridor adjacent to Lift Lobby	02	01	02
			otal	**12**

Roof Top				
Zone-A (West Side)				
1.	Stairs on roof top	03	01	03
Roof				
Zone-B (East Side)				
1.	Stairs on roof top	03	01	03
			Grand Total	**192**

Evidence Block

Sr. No	Location	No. of Location	No. of Cameras per location	Total No. of Cameras
Basement Floor				
24 Port PoE Switch				
1.	Near Stairs	01	01	01
Ground Floor				
1.	Main Entrance	02	01	02
2.	Waiting Area	02	01	02
3.	Collection Area	03	01	03
4.	Stairs	02	01	02
5.	Entrance Connecting Corridor	01	01	01
6.	Interrogation Room	01	01	01
7.	Reference Return Room	01	01	01
			Total	**12**
First Floor				
1.	Corridor adjacent to Retiring Area	01	01	01
2.	Stairs	01	01	01

3.	Area near Lift	01	01	01
4.	Open Terrace	02	01	02
			Total	**05**
		Second Floor		
1.	Stairs	01	01	01
2.	Lift	01	01	01
			Total	**02**
			Grand Total	**20**

Reception Block

Sr. No	**Location**	**No. of Location**	**No. of Cameras per location**	**Total No. of Cameras**
		Ground Floor		
		48 Port PoE Switch		
1.	Main Entrance	02	01	02
2.	Back side of Main Entrance	02	01	02
3.	Entrance Lobby	04	01	04
4.	Corridor Adjacent to Male room	02	01	02
5.	Male Room	04	01	04
6.	Corridor Adjacent to Female room	02	01	02
7.	Female Room	04	04	04
8.	Waiting Area	02	01	02
9.	Waiting Area back side	01	01	01
			Total	**23**
		First Floor		
1.	Corridor Adjacent to Male Dining Area	03	01	03
2.	Corridor Adjacent to Dining Area	04	01	04
3.	Stairs near Store	01	01	01

4.	Middle Stairs	01	01	01
			Total	09
Second Floor				
5.	Stairs	01	01	01
			Total	**01**
			Grand Total	**33**

All boundary wall cameras shall be covered with 8 port PoE Access Switches and these Access Switches shall be connected with Distribution Switch which be placed in Command & Control room at Basement Floor of Main Building.

1.1 COMMAND & CONTROL ROOM

In order to control the IP based Surveillance System, a Command & Control Room shall be established in basement floor of main building which shall house embedded Video Storage, Video Wall, Cabinets and computer system with accessories. All the IP based cameras inside the building shall be PoE enabled and connected to PoE enabled network switches and will be connected to their respective PoE enabled network switches.

The Surveillance System:

- Shall provide Live footage of all cameras inside the building, outside the building and boundary wall.
- Shall facilitate Play back option.
- Shall Record good quality video footage for last 30 days.

The purpose of Command & Control Room is to configure Surveillance devices, view and record the live footage of the cameras installed at various locations. All the main equipment required for Surveillance System shall be placed in Control Room. The Control Room shall house Embedded Video Storage of input, H.265, H.264, MJPEcompression, upto 16 TB HDD SATA Hot Swappable with RAID 5 configuration, Record Mode: Auto Record, Manual Record, Search Video Detection, alarm triggered recording, Intelligent Event, Video Analytics, Web viewer support, Search mode: Date/event/time, Redundant power, 2 USB port, HDMI port, 4 10/100/1000 Mbps Ethernet ports, supports HD video management including live video display, PTZ control, camera cycling, and video wall, support intrusion detection, tripwire crossing detection, loitering detection, fast movement detection, ONVIF support.

Console for Public Address System shall also be placed in the Command & Control Room.

Core i7 8th generation shall be installed equipped with Central Monitoring Licensed Software (CMS) and for display 7x3 Video Wall of 55" screens with HD resolution shall be installed. The Central Monitoring Licensed Software (CMS) will provide real time monitoring, play back and backup option; control all the cameras and will have multilevel user access. All the equipment placed in Control Room shall be power backed by UPS system

1.2 NETWORK INFRASTRUCTURE

The CCTV shall be based on hierarchical switching architecture that includes Core, Distribution and PoE enabled Access switches. The Core layer 2+/3 which is Network's backbone and Distribution layer will be implemented by means of one layer 2/3 Switch which shall be placed in the Command & Control Center located at basement floor of the Main Building.

Access layer shall be implemented by means of layer 2 PoE enabled switches that shall be connected to the Distribution Switch and Distribution switch shall be connected with Core switch. The proposed network inside the main building is divided into two zones. Access Switches shall be connected to Distribution Switch via ring topology on single mode Fiber Optics to provide gigabit connectivity.

Distribution layer will be an aggregation point for all Access switches and will act as integral member of Access Distribution block providing connectivity and policy services for traffic flows within the Access Distribution block. It will take the traffic coming up from Access layer and move it to embedded video storage.

The camera connectivity shall be provided through category 6 Unshielded Twisted Pair (UTP) cable. The logical diagram of the CCTV is shown in the Figure below.



1.3 SWITCHING EQUIPMENT

The core layer shall be implemented by means of a layer 2+/3 switch which shall provide high speed switching and routing services. The Distribution layer shall be implemented by Distribution Switches which shall be fixed configuration manageable Layer-2 switches. 10G port shall be used to connect distribution switches with Core Switches.

Access layer shall be realized by means of fixed configuration manageable layer 2 PoE switches with 10/100/1000 mbps to provide connectivity to cameras. The Access switches shall be installed at different areas of the buildings which will be connected to the Distribution switches through single mode fiber optics to provide gigabit connectivity. Access Switches at boundary wall shall also cater the requirement of Parameter Fencing System in terms of switches port. All the switching equipment will be provided power through UPS.

1.4 CABLING

Building backbone cabling shall be realized by means of single mode fiber optic cable which shall run in the cable tray of already included in LAN system. The horizontal cabling shall be Category 6 or higher Unshielded Twisted Pair (UTP) 4 pair cable providing secure, reliable and high-speed data communication and information sharing mechanism. The cable employed shall have excellent electrical characteristics and shall have slim design. All the cables within the

coverage zone of a specific switch shall converge to a data cabinet, typically installed/placed on the wall/floor. Proper cabling inside the cabinet shall be done by using cable managers, cable ties etc. Data Cabinet shall be secured from unauthorized access.

The fiber cabling shall be installed to cater for future expansion. Proper concealment shall be done to provide protection against rodents and to preserve the architectural beauty of the building.

The branded passive equipment including UTP cable, Patch Panels and Patch Cord shall conform to Cat 6 standard. The cabling infrastructure (fiber & UTP) shall provide 20 years warranty from principal cable manufacturer.

All the passive equipment shall be labeled as per industry standards for efficiently managing the cabling infrastructure.

The lockable glass door data cabinets/racks of adequate size for network switches, UPS and patch panels shall be installed. Sufficient fans shall be installed in the cabinets to make the cabinets cool and airy. Sufficient electrical outlets power shall be available in the data cabinets/racks.

2 ACTIVE & PASSIVE COMPONENT DETAIL

2.1 CAMERA TYPE I

Full HD IP based PoE Indoor Dome camera with 4 Mega Pixel resolution (2560 × 1440), minimum built-in IR distance at least 30 meter or more, 25/30 fps@ full HD, 2.8 -12 mm lens, H.264/H.265 compression, WDR, Back light Compensation (BLC), 10/100/1000 M Ethernet, RJ45 Port, Motion Detection, Built in web server, ONVIF support, IP 67 rating, Operating Temperature -10°C to +55°C with junction box size 4x4 and complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

2.2 CAMERA TYPE II

Full HD IP based PoE Indoor Dome camera with 4 Mega Pixel resolution (2560 × 1440), minimum built-in IR distance at least 30 meter or more, 25/30 fps@ full HD, 2.8 mm-12 mm lens, H.264/H.265 compression, WDR, Back light Compensation (BLC), 10/100/1000 M Ethernet, RJ45 Port, Motion Detection, Built in web server, ONVIF support, IP 67 rating, Operating Temperature -10°C to +55°C with junction box size 4x4 and complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

2.3 CAMERA TYPE III

Full HD IP based PoE Indoor Bullet camera with 4 Mega Pixel resolution (2560 × 1440), minimum built-in IR distance at least 50 meter or more, 25/30 fps@ full HD, 2.8 mm fixed lens, H.264/H.265 compression, WDR, Back light Compensation (BLC), 10/100/1000 M Ethernet, RJ45 Port, Motion Detection, Built in web server, ONVIF support, IP 67 rating, Operating Temperature -10°C to +55°C with junction box size 4x4 and complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

2.4 CAMERA TYPE IV

Full HD IP based PoE Indoor Bullet camera with 4 Mega Pixel resolution (2560 × 1440), minimum built-in IR distance at least 50 meter or more, 25/30 fps@ full HD, 2.8 mm fixed lens, H.264/H.265 compression, WDR, Back light Compensation (BLC), 10/100/1000 M Ethernet, RJ45 Port, Motion Detection, Built in web server, ONVIF support, IP 67 rating, Operating Temperature -10°C to +55°C with junction box size 4x4 and complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

2.5 CAMERA TYPE V

IP Based PTZ Camera with 4 Mega Pixel resolution (2560 × 1440), minimum built-in IR distance 200 meter, 40 X or more optical Zoom, Pan Range: 360º, Tilt Range: Between -10° to 90°, 500 presets or more, H.264 and H.265 video/audio compression, WDR, Back light Compensation (BLC), High Light Compensation (HLC), Motion detection, Video tampering, Network disconnection, Automatic Gain Control (AGC), audio detection, Auto tracking, Privacy masking up to 20 areas or more, Weather proof IP 66 rated, ONVIF support, Operating Temperature -10°C to +60°C with junction box size 6x4 and power adapter, complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

2.6 EMBEDDED VIDEO STORAGE

Minimum 128 Channel IP cameras input, H.265, H.264, MJPEG compression, up to 16 TB HDD SATA Hot Swappable with RAID 5 configuration, Record Mode: Auto Record, Manual Record, Search Video Detection, alarm triggered recording, Intelligent Event, Video Analytics, Web viewer support, Search mode: Date/event/time, Redundant power, 2 USB port, HDMI port, 2 10/100/1000 Mbps Ethernet ports, supports HD video management including live video display, PTZ control, camera cycling, and video wall, support intrusion detection, tripwire

crossing detection, loitering detection, fast movement detection, ONVIF support, with complete installation, configuration and testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

2.7 VIDEO WALL OF MATRIX 7X3

55" 3.5mm bezel-to-bezel LCD/LED panel, 500 cd/m², Contrast: 1200:1, Input: VGA×1, DVI×1, HDMI×1, RS232×1, USB×1, wall-mounted, Complete wall mount installation along with cabling and accessories with complete installation, and with minimum one-year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

2.8 VIDEO WALL CONTROLLER

Modular Multi-screen Controller 4U or higher, Video output through High-definition Multimedia Interface (HDMI) ports, Output 4K supported for all channels, , Microprocessor Embedded LINUX, Support 20 Slots for I/O cards or higher, Support video wall splicing with loaded 16 Inputs built-in HDMI and 22 Outputs HDMI, BNC, 2 X RJ-45 ports (10/100/1000M), RS232 ports for console and control, 1 RS485 port, 2 USB2.0, 1 USB3.0. Redundant power, with complete installation, configuration and testing and with one-year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side

2.9 CORE SWITCH

Fixed configuration manageable layer-2+/3 12 port switch for connectivity over RJ45 interface with Rack Mount Kit, 12*10GE SFP+ ports, 2*40 QSFP+ ports, redundant fans, redundant power supplies, 4GB RAM, power cable, installation, configuration & testing with standard manufacturer warranty

2.10 DISTRIBUTION SWITCH

Fixed configuration manageable layer-2/3 switch with Rack Mount Kit, 24*GE SFP port interface, 10G 2 Ports for uplink connectivity (SFP + interface), 2GB RAM, redundant power supllies, power cable, installation, configuration & testing with standard manufacturer warranty

2.11 48 PORT POE ACCESS SWITCH

Fixed configuration PoE enabled manageable layer-2 switch with Rack Mount Kit, 48-Ports 10/100/1000 Mbps RJ-45 interface for camera connectivity over UTP, 2 dual 1G Ports for uplink connectivity (SFP Interface), 802.3af compliant built-in power supply, support power budget of 380W or more, 2 GB RAM, power cable, installation, configuration & testing with standard manufacturer warranty

2.12 24 PORT POE ACCESS SWITCH

Fixed configuration PoE enabled manageable layer-2 switch with Rack Mount Kit, 24-Ports 10/100/1000 Mbps RJ-45 interface for camera connectivity over UTP, 2 dual 1G Ports for uplink connectivity (SFP Interface), 802.3af compliant built-in power supply, support 400W power budget, 2 GB RAM, power cable, installation, configuration & testing with standard manufacturer warranty

2.13 SINGLE MODE FIBER OPTICAL CABLE

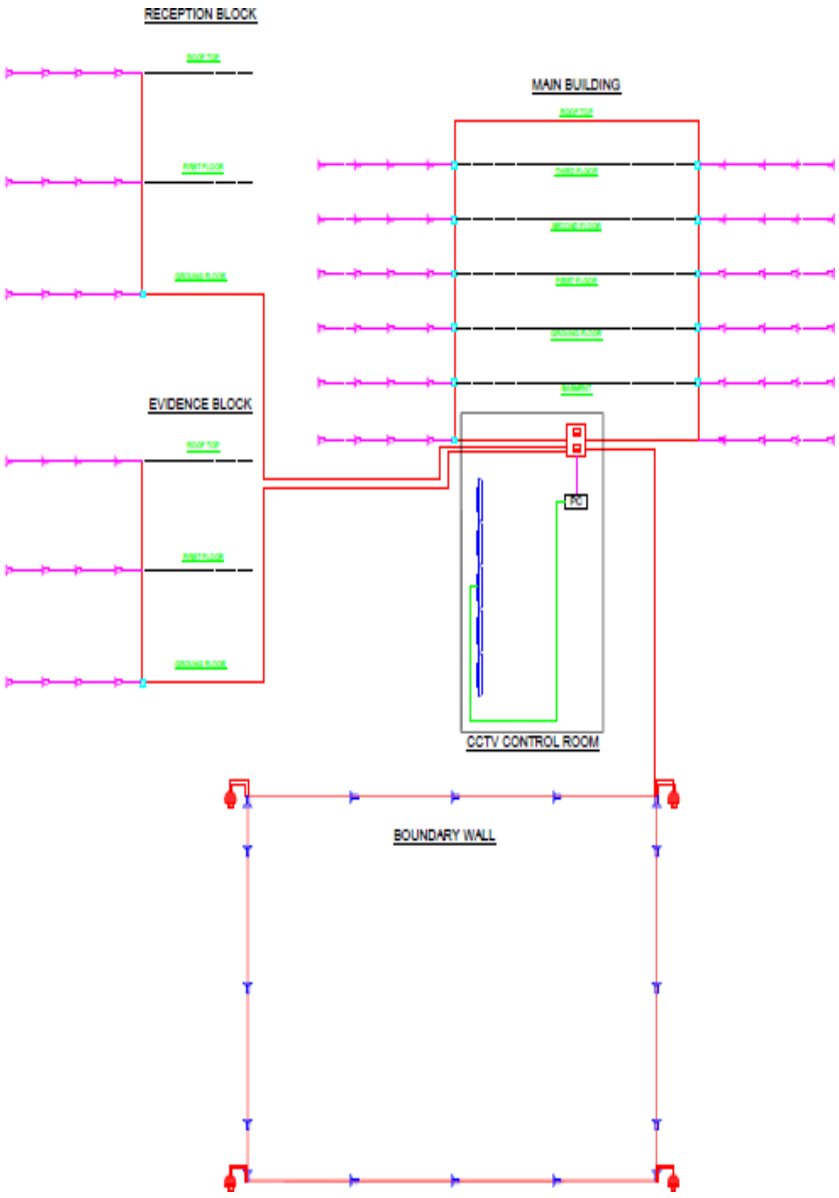
8 Core Fiber Optic Cable Single Mode with Steel Tape armored cable with complete installation, testing and minimum 20 years comprehensive warranty

2.14 UTP CABLE CAT 6

Cat-6 4 Pair U/UTP Cable with complete installation, testing and minimum 20 years comprehensive warranty.

Patch panel (24 and 48 port along with I/O), Cable managers, cable ties, labeling etc. Data Cabinets will be secured from unauthorized access by providing lock and key. Data and power cables shall be installed in separate cable trays/PVC conduits. UPS (6KVA and 1KVA) will be. Installed for power backup.

12. IP BASED CCTV SURVEILLANCE SYSTEM



APPLICABLE STANDARDS AND CODES

The latest editions of the following standards/codes shall be applicable for the materials covered within the scope of this section:

TIA/EIA 568-B.1, B.2, B.3:	Telecommunications Cabling Standard
TIA/EIA 569-A:	Commercial Pathways and Spaces
TIA/EIA 606:	Standard for Telecom Infrastructure
ITA/EIA 758:	Outside Plant Cabling Standard
ISO/IEC 11801:	Generic Cabling for Customer Premises
DIN 40040:	Class and Reliability of Units in Telecommunication

3 DRAWINGS (SHOP, AS-BUILT)

The contractor shall prepare shop drawings to indicate the exact location of security cameras, cabinets and cable routes etc. keeping in view the actual site conditions and submit for approval prior to start of cable laying process. As-built drawings shall be prepared by the Contractor after the successful testing of the cabling infrastructure.

4 INSTALLATION REQUIREMENTS

Installation of all equipment shall require close coordination between the contractor and the Client personnel. The data cabinet sizing, its exact location & power supply scheme shall be submitted for Consultant/Engineer Incharge's approval. The contractor shall ensure that the cabling and crimping/termination of installed equipment shall be done in accordance with the industry standards and supported by the Original Equipment Manufacturer (OEM).

5 TESTING & COMMISSIONING

The contractor shall make necessary arrangement including tools, access etc. for scheduled site inspections. Fluke testing of UTP & fiber links shall be conducted by the Contractor as per the approved test/commission plan by the Consultant/Engineer Incharge. The reports shall be submitted to the Client after successful completion of testing/commissioning phase.

All the active equipment shall be tested & commissioned by the Contractor as per the approved test/commission plan by the Consultant/Engineer Incharge.

6 TRAINING

The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant. However, two levels of training shall be imparted; user level and administrative/advanced level.

7 DOCUMENTATION

The contractor shall provide technical documentation that includes all layouts, complete labeling scheme, workshop/ shop drawings, CCTV network addressing scheme, active equipment configuration detail, as-built drawings, etc. which are necessary for complete installation in light of the tender documents. All user manuals shall also be submitted.

8 WARRANTY & MANAGED SERVICES

The Contractor shall provide comprehensive one year on-site warranty and managed services of all active equipment. During this period, it will be the responsibility of the Contractor to rectify any defects and provide services such as preventive maintenance, configuration of equipment, problem rectification within the permissible downtime and backup equipment inventory. The necessary patches, upgrades and updates as and when released by the original supplier shall also be provided during the warranty period so as to ensure that the system is functioning to provide the best performance. Warranty Period shall be started after signing of Handing Over/Taking Over Certificate.

The Contractor shall provide 20 years warranty for the cabling infrastructure.

SECTION – 0101

13. ACCESS CONTROL SYSTEM

1 SCOPE

The work under this section consists of supplying, installing, configuring, testing, commissioning and training of all material and services of complete Access Control System (ACS). The system shall be complete in all respect as described in these specifications, drawings, B.O.Q and in accordance with International Organization for Standardization (ISO) and Telecommunications Industry Association (TIA) recommendations.

The proposed products shall be supported by a local distributor with sufficient experience in the industry. Only the equipment approved by the engineer, shall be delivered to site or installed.

The Contractor shall discuss the cabling layout with the Engineer and co-ordinate at site for exact locations and positions of the Access Control System equipment and routing of cables etc.

The preparation of shop/As Built drawings and low level design is the responsibility of the Contractor. This specification and description is intended to set out the minimum requirements and it is expressly understood and agreed by the Contractor that anything which is usually furnished as a part of such installation as is called for in this tender and which is necessary for its proper completion, execution and function shall be furnished as a part of this specification without additional costs and extension of time whether or not shown in details on the drawings or described in particular hereinafter.

The technical documentation to be furnished by the Contractor shall include installation, testing & configuration plans, shop drawings, material/equipment submittals, as-built drawings, etc. as necessary for complete installation in light of the tender documents.

2 SYSTEM REQUIREMENTS

2.1 GENERAL

Access Control system for authorized access of Employees shall be installed at the following locations of Main Building of Sindh Forensic Science Laboratory:

Sr. No	Location	No. of Location	Type of Door
Basement Floor			
Zone-A (West Side)			
1.	Command & Control Room	1	Double Door
2.	Stairs near AHU Room	1	Single Door
3.	Mortuary Storage	1	Double Door
4.	Lift and Stairs Lobby near Driveway	1	Double Door
Basement Floor			
Zone-B (East Side)			
5.	Stairs near Gun Store	1	Double Door
6.	Stairs near Storage Room	1	Single Door
7.	Walk in Freezer	1	Double Door
8.	Walk in Refrigerator	1	Double Door
Ground Floor			
Zone-A (West Side)			
1.	Data Center	1	Double Door
Ground Floor			
Zone-B (East Side)			
2.	Polygraph Lab 1	1	Single Door
3.	Polygraph Lab 2	1	Single Door
4.	Lab 3	1	Single Door
5.	Waiting	1	Double Door
6.	Corridor near Supervisor Room	1	Double Door
7.	Processing Lab	2	Double Door
8.	Corridor near Processing Lab	1	Double Door
9.	C.S. Lab with Trace	1	Double Door
10.	Evidence Processing Lab 2	1	Double Door
First Floor			
Zone-A (West Side)			
1.	Freezer	1	Double Door
2.	Refrigerator	1	Double Door
3.	Corridor near Freezer	1	Double Door
4.	DNA Database Codis	1	Double Door
5.	DNA Stock Store	1	Double Door
6.	DNA Analytical Room	2	Double Door
7.	Screening	1	Double Door
8.	DNA Evidence Extraction Room	2	Double Door
First Floor			
Zone-B (East Side)			
9.	Instrumentation Room	1	Double Door
10.	Extraction	1	Double Door
11.	Microscopy Lab	1	Double Door
12.	Solvent Room Lab 5	1	Double Door

13.	Lab 6	1	Double Door
14.	Unassigned Lab 4	1	Double Door
15.	Trace Evidence Liquor Sampling Room	1	Double Door
16.	Trace Evidence Vault	1	Double Door
17.	Explosives Lab 1	1	Double Door
18.	Chromatography Gas Room Lab 2	1	Double Door
19.	Corridor near Chromatography Gas Room	1	Double Door
20.	Corridor near Lab 5	1	Double Door
Second Floor			
Zone-A (West Side)			
1.	Pathology and Histology Tissue Lab 1	1	Double Door
2.	Walk in Freezer Pathology	1	Double Door
3.	Corridor near Walk in Freezer Pathology	1	Double Door
4.	Histology Lab 2	1	Double Door
5.	VSC Lab 1	1	Double Door
6.	ESDA Lab 2	1	Double Door
7.	Autopsy Hall	1	Double Door
Second Floor			
Zone-B (East Side)			
8.	Walk in Freezer	1	Double Door
9.	Toxicology Sampling Room	1	Double Door
10.	Corridor near Walk in Freezer	1	Double Door
11.	Toxicology Extraction Room	1	Double Door
12.	Toxicology Instrumentation Room	1	Double Door
13.	Toxicology Record Room	1	Double Door
14.	Toxicology Workstations	1	Double Door
15.	Corridor near Quality Assurance Rooms	1	Double Door
Third Floor			
Zone-A (West Side)			
1.	FTM 1	1	Single Door
2.	CSI 4	1	Single Door
3.	QD 2	1	Single Door
4.	Narcotics 3	1	Single Door
5.	Pathology 6	1	Single Door
6.	TOX 8	1	Single Door
7.	TOX	1	Single Door
8.	DNA 9	1	Single Door

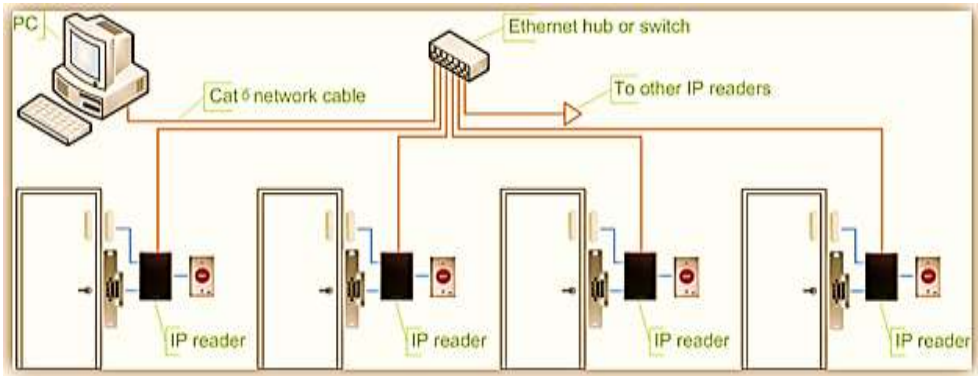
2.2 ACCESS CONTROL SYSTEM INFRASTRUCTURE

Access Control System shall consist of RFID readers which shall be installed on the locations mentioned above. The System shall comprise of Readers, Network Switches, Door Locks, Computer and Access Control Software which in turn shall communicate with each other. Failure of one reader shall not affect any other reader in the system. System shall have a facility to create different authority Levels for Supervisor/Administrator/User on the device. All the readers shall communicate through CAT 7 cable with the centralized computer. The System shall have the facility to block certain employee's access to certain areas as per SOP defined by the Authorities.

The system shall record and display the entry information through standard software which shall be installed in the Computer machine. Readers shall be installed on double doors and single doors as per requirements which shall authenticate and authorize entry. Each door shall have one reader to record entry and on other side of the door, manual push button shall be installed for exit. All the doors shall be fitted with electronic bolt locks.

Software shall generates various entry reports like ALL entries, first & last entry, IN entry, based on selectable options of users, user groups, date and time. The system shall have a provision that reports can be exported in Excel, PDF, CSV formats to integrate with any third party software.

The logical diagram of the LAN is shown in the Figure 1.1.



3 ACTIVE & PASSIVE COMPONENT DETAIL

3.1 IP BASED BIOMETRIC + RFID READER

IP Based Biometric + RFID Color 2.4¨ or higher LCD Touch Screen Card Reader shall be installed which has following features:

Function and navigation keys, Store Finger Print Templates of 2000 users or more, Transactions: 50,000 or more, Image Resolution: 500 dpi or higher High quality scratch resistance optical sensor, Response time: < 2 sec, Verification modes: Fingerprint, Card, Operation mode: card only, finger only, card + finger, Standard Connectivity: TCP/IP and high speed USB 2.0, FAR/FRR: < 0.001 %/0.1 %, Prominent audio & visual indication for acceptance/rejection of valid/invalid user, Facility to create different Authority Levels for Supervisor/Administrator/User on the device , There should be a facility to verify card or Finger before admin login, Reader shall flash LED and emit a short beep indicating that a card was read , Employee Name/Employee code number should be displayed on the LCD screen along with Access granted, The reader should function in standalone mode when network fails , If any person is trying to open the device an alarm should be raised , Reader should be able to detect the Fake Fingerprints when placed on the sensor. It should accept only live fingerprint and should not read the fake fingerprints made of any chemical composition such as Rubber, Silicon, Gel, Paper, Thin film etc., Provision for setting the time of all machines from a single location to maintain uniform time in all locations , The connectivity of the devices should be detected remotely from remote machine, should have inbuilt capability for online firmware up gradation, Wall mounted, Built in Battery Backup, Temperature: 0 degree C to 50 degree C with complete installation, configuration & testing and with one year comprehensive warranty minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side..

3.2 ACCESS CONTROL SOFTWARE

Web Based Interface, Record entry and exit events, generate reports (for the specific areas, department, date, etc.), facility to block certain employees access to certain areas due to some reason, Opening and closing of the doors should be possible from PC, Wiegand, Serial, door setting can be configured through access control software, Provision to export reports in Excel, PDF, CSV formats to integrate with any third party software.

3.3 ACCESS CONTROL COMPUTER

Detail of Computer required for Access Control System is mentioned in the Employee Attendance System section. Employee Attendance Computer shall also be used for Access Control System.

3.4 NETWORK SWITCHES

Detail of Network Switches required for Access Control System is mentioned in the Local Area Network section.

3.5 SINGLE LEAF EM LOCK

Surface Mount Electromagnetic Lock with built in magnetic read switch, U/ L/ Z brackets based on the site conditions, EM lock should be suitable for surface

mount on single leaf doors, Input Voltage 12 V, Tensile force range: 120k g±8 %.

3.6 DOUBLE LEAF EM LOCK

Surface Mount Electromagnetic Lock with built in magnetic read switch, U/ L/ Z brackets based on the site conditions, EM lock should be suitable for surface mount on double leaf doors, Input Voltage 12 V, Tensile force range: 120k g±8 %

3.7 EXIT BUTTON

Exit button from inside for each identified access location room doors for door release, Switch should make of Stainless steel or better material, Maximum Current: 2A, 12/24V DC or better.

3.8 ELECTRIC CABLE

Electric Cable 3/29 2 Core shall be used.

3.9 UTP CABLE

Detail of UTP cable required for Access Control System is mentioned in the Local Area Network section.

3.10 PROXIMITY CARDS

EM/Mifare cards with printing shall be provided by the Contractor.

4 APPLICABLE STANDARDS AND CODES

The latest editions of the following standards/codes shall be applicable for the materials covered within the scope of this section:

Structured Cabling System Standard ANSI/TIA/EIA 568 series
Labeling Standard TIA/EIA 606 series

5 DRAWINGS (SHOP, AS-BUILT)

The contractor shall prepare shop drawings to indicate location of Access Control System equipment, cable routes etc. keeping in view the actual site conditions and submit for approval prior to start of cable laying process. As-built drawings shall be prepared by the Contractor after the successful testing of the cabling infrastructure.

6 INSTALLATION REQUIREMENTS

Installation of all equipment shall require close coordination between the contractor and the Client personnel. RFID reader’s exact location shall be submitted for Consultant/Engineer Incharge’s approval. The contractor shall

ensure that the cabling and crimping/termination of installed equipment shall be done in accordance with the industry standards and supported by the Original Equipment Manufacturer (OEM).

7 TESTING & COMMISSIONING

The contractor shall make necessary arrangement including tools, access etc. for scheduled site inspections. The reports shall be submitted to the Client after successful completion of testing/commissioning phase.

All the active equipment shall be tested & commissioned by the Contractor as per the approved test/commission plan by the Consultant/Engineer Incharge.

8 TRAINING

The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant. However, two levels of training shall be imparted; user level and administrative/advanced level.

9 DOCUMENTATION

The contractor shall provide technical documentation that includes all layouts, complete labeling scheme, workshop/ shop drawings, network addressing scheme, active equipment configuration detail, as-built drawings, etc. which are necessary for complete installation in light of the tender documents. All user manuals shall also be submitted.

10 WARRANTY & MANAGED SERVICES

The Contractor shall provide comprehensive one year on site warranty and managed services of all active equipment. During this period, it will be the responsibility of the Contractor to rectify any defects and provide services such as preventive maintenance, configuration of equipment, problem rectification within the permissible downtime and backup equipment inventory. The necessary patches, upgrades and updates as and when released by the original supplier shall also be provided during the warranty period so as to ensure that the system is functioning to provide the best performance.

The product shall be warranted to be free from defects in material and workmanship under normal use for a period of one year from the date of commissioning or final acceptance.

SECTION – 8375

14. EMPLOYEE ATTENDANCE SYSTEM

1 SCOPE

The work under this section consists of supplying, installing, configuring, testing, commissioning and training of all material and services of complete Employee Attendance System. The system shall be complete in all respect as described in these specifications, drawings, B.O.Q and in accordance with International Organization for Standardization (ISO) and Telecommunications Industry Association (TIA) recommendations.

The Contractor shall discuss the cabling layout with the Engineer and co-ordinate at site for exact locations and positions of the Biometric/RFID Readers and routing of cables etc.

The preparation of shop/As Built drawings and low level design is the responsibility of the Contractor. This specification and description is intended to set out the minimum requirements and it is expressly understood and agreed by the Contractor that anything which is usually furnished as a part of such installation as is called for in this tender and which is necessary for its proper completion, execution and function shall be furnished as a part of this specification without additional costs and extension of time whether or not shown in details on the drawings or described in particular hereinafter.

The technical documentation to be furnished by the Contractor shall include installation, testing & configuration plans, shop drawings, material/equipment submittals, as-built drawings, etc. as necessary for complete installation in light of the tender documents.

2 SYSTEM REQUIREMENTS

2.1 GENERAL

The Employee Attendance System (EAS) shall be installed to record, evaluate and manage the attendance activities of employees of Sindh Forensic Science Laboratory using Attendance software. The software shall be capable to store and track the employee time related information.

This system shall comprise of Biometric and RFID readers which shall be installed at the main reception of Main building of Sindh Forensic Science Laboratory.

These readers shall read and store the attendance data in the central database and the reports shall be generated with the help of software. System shall have a facility to create different authority Levels for Supervisor/Administrator/User on the device.

The logical diagram of the Employee Attendance System is shown in Figure 1.1.

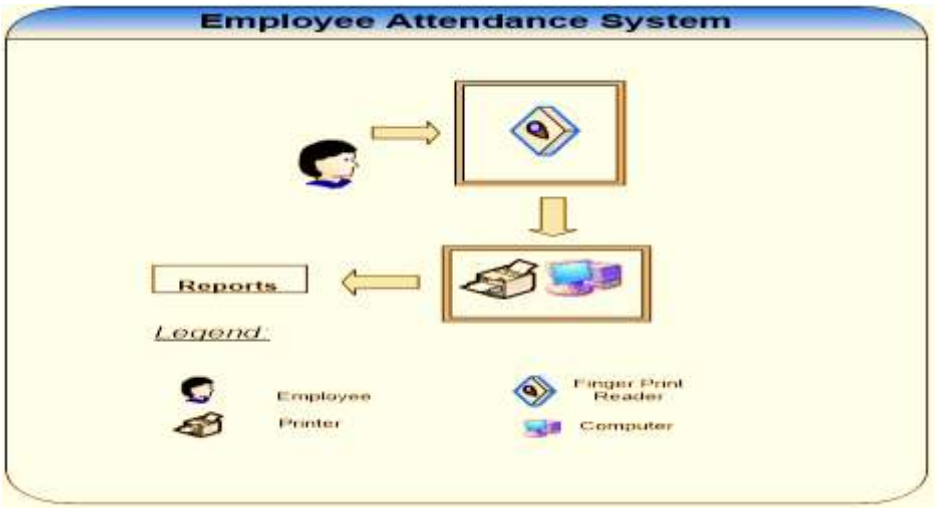


Fig 1.1: Logical Diagram of Employee Attendance System

3 ACTIVE & PASSIVE EQUIPMENT DETAIL

3.1 IP BASED BIOMETRIC + RFID READER

IP Based Biometric + RFID Color 2.4¨ or higher LCD Touch Screen Card Reader shall be installed with following features:
Function and navigation keys, Store Finger Print Templates of 2000 users or more, Transactions: 50,000 or more, Image Resolution: 500 dpi or higher High quality scratch resistance optical sensor, Response time: < 2 sec, Verification modes: Fingerprint, Card, Operation mode: card only, finger only, card + finger, Standard Connectivity: TCP/IP and high speed USB 2.0, FAR/FRR: < 0.001 %/0.1 %, Prominent audio & visual indication for acceptance/rejection of valid/invalid user, Facility to create different Authority Levels for Supervisor/Administrator/User on the device , facility to verify card or Finger before admin login, Reader shall flash LED and emit a short beep indicating that a card was read , Employee Name/Employee code number should be displayed on the LCD screen along with Access granted, The reader should function and record attendance even in standalone mode when network fails , If any person is trying to open the device an alarm should be raised , Reader should be able to

detect the Fake Fingerprints when placed on the sensor. It should accept only live fingerprint and should not read the fake fingerprints made of any chemical composition such as Rubber, Silicon, Gel, Paper, Thin film etc., Provision for setting the time of all machines from a single location to maintain uniform time in all locations , The connectivity of the devices should be detected remotely from remote machine, should have inbuilt capability for online firmware up gradation , Wall mounted, Built in Battery Backup, Temperature: 0 degree C to 50 degree C with complete installation, configuration & testing and with one year comprehensive warranty minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

3.2 ATTENDANCE SOFTWARE

Attendance Software shall have the following features:
Web Based Interface, Record employees detail (Employee Name, Employee ID, Photo Image, Department, Designation, Date of joining etc.), Record fingerprint templates, Record arrival and departure events, Record overtime of employees, Record daily late arrivals, Record early departure, Record daily absentees, Record casual, sick & earned leaves, Record extraordinary leaves, Create schedules (Gazetted holidays, etc.), Provision for advance entry of leaves (casual, earned, extraordinary, Capable to store, match and search for the registered fingerprint templates in the database, Generate reports (for the specific person, department, date, late comers, punctual employees, daily, weekly and monthly attendance, employee check-in and check-out log, leave status report of employee, etc.), Record Maternity and paternity leaves Support, Provision to export reports in Excel, PDF, CSV formats to integrate with any third party software.

3.3 ATTENDANCE COMPUTER

Intel Core i7 11th Generation Processor or higher with 3.4 GHz and above speed, Mother Board: Intel Original, 8 GB DDR4 or higher memory, Hard Disk Drive: 1 TB 7200 RPM, Built in Sound Card , Built-in Network Adapter 10/100/1000 base-T Ethernet card, USB Keyboard, USB Optical Mouse with mouse pad, 6 x USB 3.0 or more I/O interface, 1 x HDMI port, Tower casing having FAN with manufacturer standard power watt, Pre-installed Operating System: Microsoft Windows 10 Pro 64 bit (Licensed), 24" branded LED screen with complete installation, configuration & testing and with minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side shall be installed in the Network Operation Center (NOC) of Data Center located in ground floor of Main Building. The Computer systems shall be UPS protected.

This Computer shall also be used for the Access Control System.

3.4 NETWORK SWITCHES

Detail of Network Switches required for Employee Attendance System is mentioned in the Local Area Network section.

3.5 UTP CABLE

Detail of UTP cable required for Employee Attendance System is mentioned in the Local Area Network section.

4 APPLICABLE STANDARDS

Structured Cabling System Standard ANSI/TIA/EIA 568 series
Labeling Standard TIA/EIA 606 series

5 DRAWINGS (SHOP, AS-BUILT)

The contractor shall prepare shop drawings to indicate location of Readers, cable routes etc. keeping in view the actual site conditions and submit for approval prior to start of cable laying process. As-built drawings shall be prepared by the Contractor after the successful testing of the cabling infrastructure.

6 INSTALLATION REQUIREMENTS

Installation of all equipment shall require close coordination between the contractor and the Client personnel. Readers exact location detail shall be submitted for Consultant/Engineer Incharge's approval. The contractor shall ensure that the cabling and crimping/termination of installed equipment shall be done in accordance with the industry standards and supported by the Original Equipment Manufacturer (OEM).

7 TESTING & COMMISSIONING

The contractor shall make necessary arrangement including tools, access etc. for scheduled site inspections. The reports shall be submitted to the Client after successful completion of testing/commissioning phase.

All the active equipment shall be tested & commissioned by the Contractor as per the approved test/commission plan by the Consultant/Engineer In charge.

8 TRAINING

The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant. However, two levels of training shall be imparted; user level and administrative/advanced level.

9 DOCUMENTATION

The contractor shall provide technical documentation that includes all layouts, complete labeling scheme, workshop/ shop drawings, active equipment configuration detail, as-built drawings, etc. which are necessary for complete installation in light of the tender documents. All user manuals shall also be submitted.

10 WARRANTY & MANAGED SERVICES

The Contractor shall provide comprehensive one year onsite warranty and managed services of all active equipment. During this period, it will be the responsibility of the Contractor to rectify any defects and provide services such as preventive maintenance, configuration of equipment, problem rectification within the permissible downtime and backup equipment inventory. The necessary patches, upgrades and updates as and when released by the original supplier shall also be provided during the warranty period so as to ensure that the system is functioning to provide the best performance.

SECTION – 8376

15. MICROPHONE CONFERENCING SYSTEM

1 SCOPE

The work under this section consists of supplying, installing, configuring, programming, testing, commissioning and training of all material and services of complete Microphone Conferencing System (MCS) for Conference Room. The system shall be complete in all respect as described in these specifications, drawings, B.O.Q and in accordance with International Organization for Standardization (ISO) and Telecommunications Industry Association (TIA) recommendations.

The Contractor shall discuss the cabling layout with the Engineer and co-ordinate at site for exact locations and positions of the Microphone Conferencing System equipment and routing of cables etc.

The preparation of shop/As Built drawings and low level design is the responsibility of the Contractor. This specification and description is intended to set out the minimum requirements and it is expressly understood and agreed by the Contractor that anything which is usually furnished as a part of such installation as is called for in this tender and which is necessary for its proper completion, execution and function shall be furnished as a part of this specification without additional costs and extension of time whether or not shown in details on the drawings or described in particular hereinafter.

The technical documentation to be furnished by the Contractor shall include installation, testing & configuration plans, shop drawings, material/equipment submittals, as-built drawings, etc. as necessary for complete installation in light of the tender documents.

2 SYSTEM REQUIREMENTS

2.1 GENERAL

A Flush Mounted state of the art Microphone Conferencing System shall be designed for Conference Room with seating capacity of 42 people located in Ground floor as marked in layout plans of Main Building of Sindh Forensic Science Laboratory.

2.2 MICROPHONE CONFERENCING SYSTEM INFRASTRUCTURE

This conference system shall consist of following components:

1. Chairman unit
2. Delegate units
3. Control Unit with Built in Recording & Management Software
4. UPS of size 2 KVA

A chairman unit shall be installed for chairperson and Forty-One (41) delegate units shall be proposed for participants of the meeting. These units shall be mounted on table with concealed wiring which shall be going under table in cable tray. All units shall be equipped with Built-in loudspeaker with volume control. Chairman unit shall be able to control delegate units by an additional button which shall switch off speaking delegate units at any time.

A control unit which is the central part of the system shall be connected to the delegate units and a chairman unit. This unit shall be placed in any nearest location to control all the units. Control unit shall be supported by Management Software.

All delegate units shall be connected to one another in the form of daisy chain through a single cable. This cable shall carry audio, data and power of each delegate unit. The UPS backup shall be proposed for this system. Logical diagram of Microphone Conferencing System is shown in Figure 1.1.

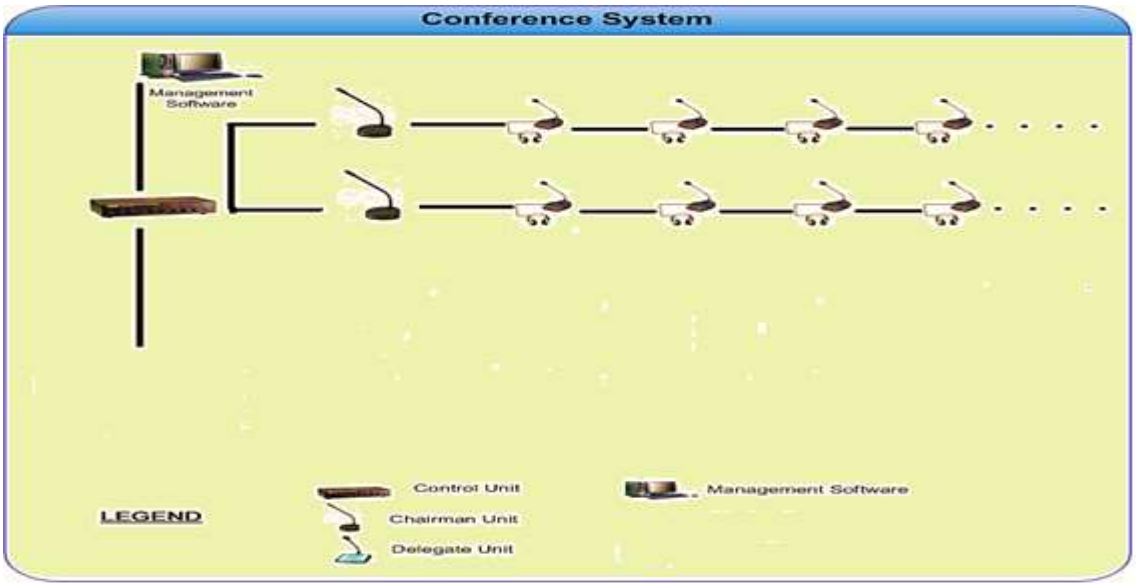


Figure: Microphone Conferencing System

3 ACTIVE & PASSIVE COMPONENT DETAIL

3.1 CENTRAL CONTROL UNIT

Central control unit of the digital Conference System shall be installed which is capable to Control 42 delegate units and expandable up to 100 units, Support centralized power supply to delegate units, Single connection between the central unit and the Chairman/delegate units by means of cable, Capable to implement Speech duration period, Support Chairman Unit capability to switch on or off any delegate unit, Speaking time limit can be pre-set for conference units, built in recording software which is capable to record and replay speech of delegate unit and Chairman unit, installation & testing and minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side

3.2 FLUSH MOUNT CHAIRMAN UNIT

Flush Mount Chairman unit shall allow the delegate to talk, request to talk, additional priority button to override all active delegate units, Speaker automatically mutes when the microphone is turned on, Low susceptibility to mobile phone interference, Headphones volume control, Equipped with loud speaker and microphone, provision of headphone port, Centrally Powered and Controlled, Light Indication on Microphone when it is on, installation & testing and minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

3.3 FLUSH MOUNT DELEGATE UNIT

Flush Mount Delegate unit shall allow the delegate to talk, request to talk, Speaker automatically mutes when the microphone is turned on, Low susceptibility to mobile phone interference, Headphones volume control, Equipped with loud speaker and microphone, provision of headphone port, Centrally Powered and Controlled, Light Indication on Microphone when it is on, installation & testing and minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

3.4 UPS OF SIZE 2 KVA

UPS of size 2KVA with 10 minutes battery backup shall be installed with complete installation & testing and minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

3.5 NETWORK SWITCH

Detail of Network Switch required for Microphone Conferencing System is mentioned in Local Area Network section.

3.6 NETWORK CABLE FOR CONNECTING ALL UNITS

Networking cable & connectors for connecting all units with complete installation, testing & commissioning.

4 APPLICABLE STANDARDS AND CODES

The latest editions of the following standards/codes shall be applicable for the materials covered within the scope of this section:

Telecommunications Infrastructure Standard: TIA-942
Structured Cabling System Standard ANSI/TIA/EIA 568 series
Labeling Standard TIA/EIA 606 series

5 DRAWINGS (SHOP, AS-BUILT)

The contractor shall prepare shop drawings to indicate location of Microphone Conferencing System equipment, cable routes etc. keeping in view the actual site conditions and submit for approval prior to start of cable laying process. As-built drawings shall be prepared by the Contractor after the successful testing of the cabling infrastructure.

6 INSTALLATION REQUIREMENTS

Installation of all equipment shall require close coordination between the contractor and the Client personnel. Exact location of all Equipment shall be submitted for Consultant/Engineer Incharge's approval. The contractor shall ensure that the cabling and crimping/termination of installed equipment shall be done in accordance with the industry standards and supported by the Original Equipment Manufacturer (OEM).

7 TESTING & COMMISSIONING

The contractor shall make necessary arrangement including tools, access etc. for scheduled site inspections. The reports shall be submitted to the Client after successful completion of testing/commissioning phase.

All the active equipment shall be tested & commissioned by the Contractor as per the approved test/commission plan by the Consultant/Engineer Incharge.

8 TRAINING

The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant. However, two levels of training shall be imparted; user level and administrative/advanced level.

9 DOCUMENTATION

The contractor shall provide technical documentation that includes all layouts, complete labeling scheme, workshop/ shop drawings, network addressing scheme, active equipment configuration detail, as-built drawings, etc. which are necessary for complete installation in light of the tender documents. All user manuals shall also be submitted.

10 WARRANTY & MANAGED SERVICES

The Contractor shall provide comprehensive one year onsite warranty and managed services of all active equipment. During this period, it will be the responsibility of the Contractor to rectify any defects and provide services such as preventive maintenance, configuration of equipment, problem rectification within the permissible downtime and backup equipment inventory. The necessary patches, upgrades and updates as and when released by the original supplier shall also be provided during the warranty period so as to ensure that the system is functioning to provide the best performance.

16. SERVERS, STORAGE, VIRTUALIZATION, SOFTWARE IMPLEMENTATION

1 SCOPE

The work under this section consists of supplying, installing, configuring, programming, testing, commissioning and training of all material and services of Servers, Storage, Virtualization, Software licenses and backups at Primary and Disaster Recovery sites. The system shall be complete in all respect as described in these specifications, drawings, B.O.Q and in accordance with industry standards with high reliability, fault tolerance, redundancy and high availability.

The Contractor shall discuss the deployment plan with the Engineer and co-ordinate at site for installation and configuration of IT equipment as per requirement provided by the engineer.

The preparation of shop/As Built drawings and low-level design is the responsibility of the Contractor. This specification and description is intended to set out the minimum requirements and it is expressly understood and agreed by the Contractor that anything which is usually furnished as a part of such installation as is called for in this tender and which is necessary for its proper completion, execution and function shall be furnished as a part of this specification without additional costs and extension of time whether or not shown in details on the drawings or described in particular hereinafter.

The technical documentation to be furnished by the Contractor shall include installation, testing & configuration plans, shop drawings, material/equipment submittals, as-built drawings, etc. as necessary for complete installation in light of the tender documents.

2 SYSTEM REQUIREMENTS

2.1 GENERAL

The IT infrastructure consisting of Servers, Storage, Virtualization shall be established to host the Forensic Laboratory applications with other system software. Keeping in view the importance of efficient and effective response System, a high reliable, fault tolerance, redundant and high available system architecture shall be designed for Sindh Forensic Laboratory applications/software. The system Infrastructure shall be scalable to cater for the future needs and capable of hosting new Applications.

2.2 SERVER INFRASTRUCTURE

The Servers, Storage boxes and other related hardware shall be unboxed and installed in the server racks under the supervision of the Engineer. The servers shall be configured in redundant and high available architecture to reduce the chance of single point of failure. The Servers shall be connected with each other and with Storage on minimum 32 Gbps channel achieving the maximum and fast data read and write speed. All the IP/network communication links of Servers SAN with network devices shall be operated on 25 Gbps or higher to achieve maximum response time. All the inter related communication links shall be redundant.

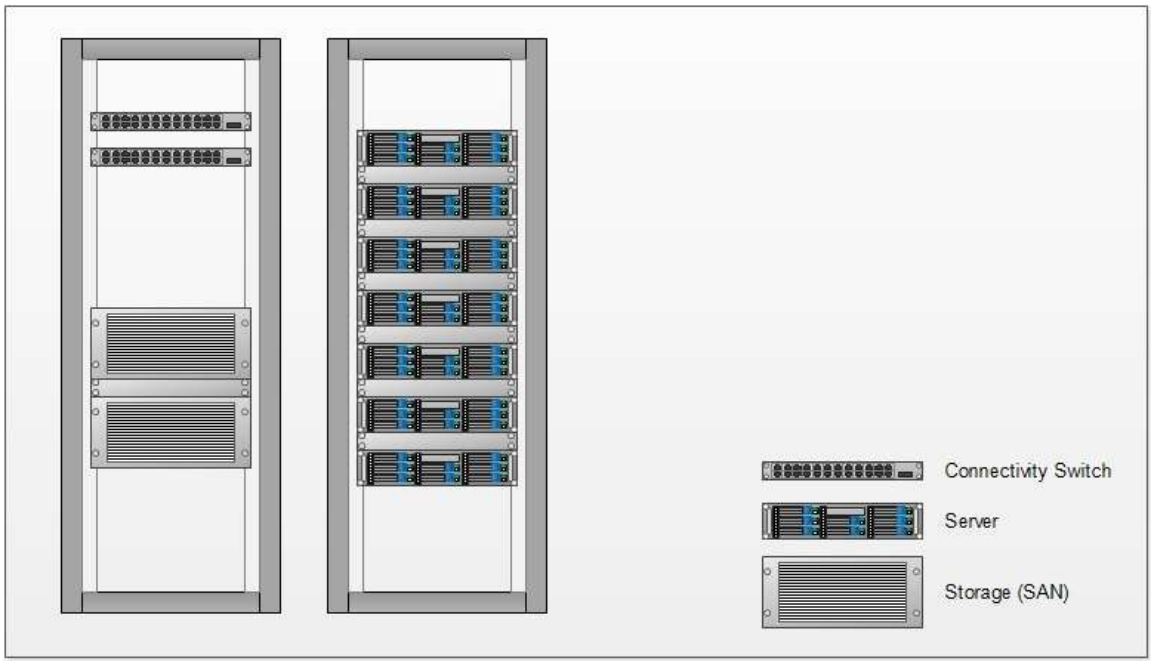


Figure: Logical Drawing of Servers and Storage in Racks

2.3 VIRTUALIZED PLATFORM

The Virtualized platform on the servers shall be setup for the Forensic Information system, reporting system, Accounting and other required Applications/software. All servers shall be configured with high available model so that in case of any server failure all the virtual machines shall be online for end users without any down time required for migration of VMs. The virtual machines shall be created and configured as per the requirements of specific software/application and with the coordination of the site engineer.

2.4 APPLICATION/SOFTWARE INSTALLATION

All IT application/software shall be installed on the Virtual machines under the close coordination of the software/application experts. Contractor shall provide the required base line configuration/software for the installation of the Forensic application/software. Besides these applications, the contractor shall configure the other required solution/application for example, domain controller, additional domain controller, Network monitoring solution, Antivirus solution etc.

2.5 AUTOMATIC BACKUP MODEL

All application/software virtual machines including critical data shall be automatically backup on the backup appliance. The contractor shall discuss the backup policy with the engineer and as per requirement the backup policy shall be implemented for the virtual machines. Backup of virtual machines shall include the regular or time defined snapshots capturing so that in case of any damage the virtual machine can be recovered from any specific time frame.

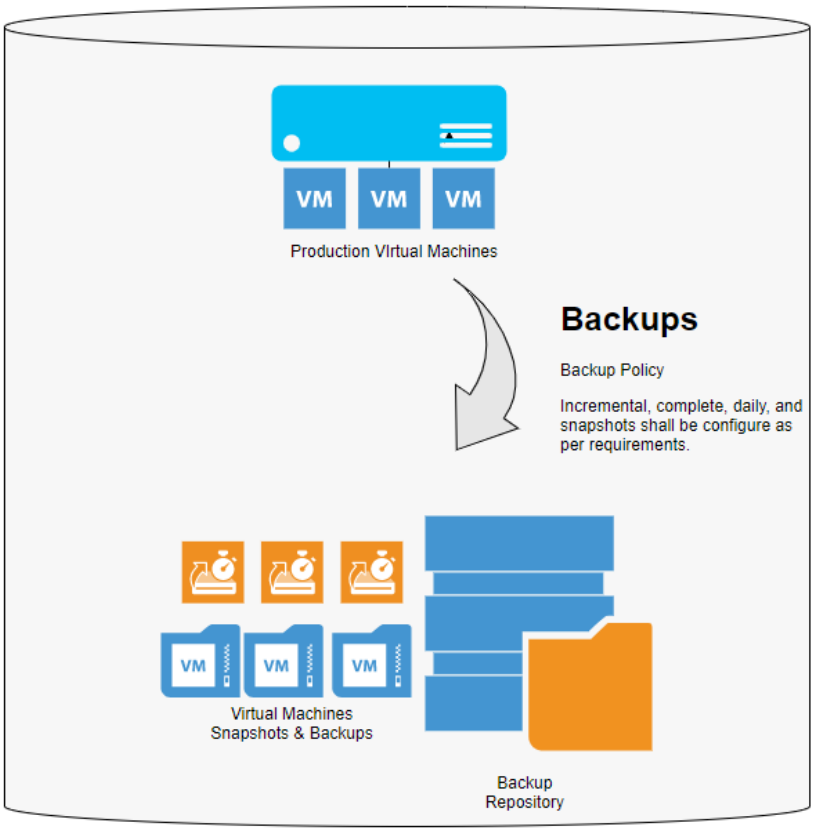


Figure: Logical Drawing of Backup Architecture

3 ACTIVE & PASSIVE COMPONENT DETAIL

3.1 PRIMARY SITE

The specifications provided in this section are general and provided as a base line for the contractor. It is recommended to provide the hardware equipment from the same manufacturer to avoid the interoperability issues. The contractor may propose the latest/higher specifications for the IT hardware and software items.

3.1.1 Server - Virtualization Host (Quantity – 06)

- 2.5" Chassis with up to 12 SAS/SATA Drives, 2 CPU
- 2 x Intel® Xeon® Gold Processor, 28C/56T,
- 12 x 64GB RDIMM
- 2 x 240GB SSD Hot-Plug
- Dual, Hot-Plug, Fully Redundant Power Supply (1+1),
- Remote Access Controller supported
- Dual Port 10/25GbE with SFP module
- Quad Port 1GbE BASE-T Adapter, PCIe
- Dual Port 10/25GbE with SFP module, PCIe
- Rack mountable, Sliding Rails With Cable Management Arm
- Support and warranty for 1 year

3.1.2 Storage Solution (Quantity – 01 Job)

- The unified storage requirement is divided into Structured and Un-structured data. The overall usable storage shall be minimum 200 TB Raw Physical capacity and can be extendable up to 2 petabytes.
- 30 % of the overall usable storage shall be used for structured data.
- 70% of the overall usable storage shall be used for Un structured data
- It is recommended to have dedicated storages boxes for structured and un-structured data to achieve maximum performance.
- For Structured Data and Unstructured Data:
- Symmetric Active Active Controllers (64 Cores)
- TLC NVMe SSD drives shall be provided in the Storage
- Shall support future expansion in NVMe, end to end NVMe
- Should Support Active-Active Replication for SAN and NAS,
- The data communication link shall be minimum 25Gb

- Dual controller offered storage should not have any single point of failure.
- Hot spare drives must be available for fault tolerance
- Capacity planning chart must be shared with proposal.
- Minimum one hot spare drive per disk type must be proposed.
- Disk backend connectivity must be 25 Gbps or Higher
- Offered Storage shall support standard protocols FC, FCoE, iSCSI, to provide host connectivity.
- Redundant Power supply
- Rack rails
- Must support Microsoft Windows Server 2012 and 2012 R2; Red Hat Enterprise Linux (RHEL) 6 and 7; SUSE Linux Enterprise Server (SLES) 11 and 12; VMware vSphere 5.1, 5.5, and 6.0.
- The contractor shall provide redundant SAN switches which shall be connected as per the data ports available in Servers and SANs.
- OM4 LC/LC multi-mode fiber cable patches 5 Meter or any other required Cables for data channel connectivity between Servers and SAN shall be provided accordingly.
- Support and warranty for 3 year

3.1.3 Backup Solution (Quantity – 01 Job)

- Backup of the Production data is also divided into two separate approaches. One the backup of structured data and second is to backup un-structured data.
- For Structure Data:
- Should be a Purpose-Built Backup Storage with Fast Backup, Recovery and Data Reduction
- Active-Active Dual Controllers
- Required Usable Capacity 100 TB with RAID up to 300TB
- Redundant Power Supplies
- Should have min 4 x 10G ports
- Should have iSCSI, FC and NFS Protocol support
- Support Compression & Deduplication
- Rack Mount Kit

Backup Software:

- included and must be capable for complete/ detailed backup scheduling and automation
- Software should provide support for CDP (Continuous Data Protection) functionality to eliminate downtime and minimize data loss for Critical workloads and perform immediate recoveries to a latest state or desired

point in time achieving the most stringent RTO and RPO, Should Support Encryption, Secure Snapshots

- Backup Software License should be based on 250VMs / 250TB FE Capacity or 100TB BE Capacity
- Solution should maintain complete control of data protection for ALL virtual, physical workloads by managing both hypervisor-based and agent-based backups natively through one single console
- Must be capable for: Dedupe / compress, Integrate with Backup solution at DR, Solution must capable for track/maintain the backup logs.
- Must Support Industry Leading Operating Systems and virtualization platform: AIX, Windows, Linux, Solaris, VMware, Hyper-V, Oracle and SQL,
- Proposed software can replicate data at DR site
- Proposed software must capable for Snapshot.
- Proposed Backup Storage should be compatible with Veeam, Veritas, Commvault and other backup software,
- Support and warranty of hardware for 3 years and backup software for 3 years

3.1.4 Virtualization Platform for Primary Site

Virtualization Management Software (01 Instance)

- The proposed Solution must provide High Availability / Redundancy for the Virtualization Management Platform on the DR Site in case of any disaster
- Must support to create and manage local Users with Role Based Access and Permission Control
- Must provide Web Bowser-based Management Console
- Must provide complete visibility and centralized management/control of the Virtualization Platform
- Must provide the capability to scale up to 64 nodes or better

Compute Virtualization (08 Sockets)

- Proposed Solution should be highly redundant providing capability for the VMs to restart on another node in case of any Node failure in the Cluster
- Must provide VM Snapshot capability to revert back to the previous point in time in case a failure or system error occurs
- Must provide VM Clone capability for creating cloned instances from source VM for testing or any other purposes
- Must provide VM vMotion capability to Live migrate VMs to any nodes in the Cluster without any downtime
- Must provide the capability to automatically hot-add resources including vCPUs and Memory real-time based on VM contention
- Must provide automated Resource Scheduling and Load Balancing capability for balanced performance on all nodes across the cluster
- Must provide Distributed Switch capability to configure and administer switching for the entire Cluster

- Must provide Hardware Health Check capability to Monitor CPU, Memory, Network Interface Card, Hard Drive and RAID Controller etc

3.1.5 Microsoft Windows Server Standard

- Microsoft Windows Server Standard 2022 or latest
- Core based license
- All cores of the active 04 x Servers must be licensed

3.1.6 Microsoft SQL Server

- Microsoft SQL Server Standard/Enterprise licenses shall be required for the Forensic software/applications. The 2 core based or higher License is required.

3.1.7 Antivirus Management Solution

- Licensed for 3 years Complete Antivirus solution with 24X7 Technical Support including end point protection for:
- 30 x Server VMs
- Must Support Centralized Endpoint Installation Via Active Directory
- Initially 300 x Endpoint Nodes/Users
- Complete set of Endpoint Protection Features including ransomware protection
- Must Support Ransomware File Protection
- Must Support Windows Patching.
- Must Support USB Security Control for Unauthorized USB Devices
- Must Support Deep Learning / Artificial Intelligence Malware Detection
- Must Include Cloud-Sandbox Capability for Realtime Security Detection
- Reporting and centralized management interface must be full

4 INSTALLATION REQUIREMENTS

Installation of all equipment shall require close coordination between the contractor and the Client personnel. The contractor shall gather the requirements from the site engineer and shall provide the installation plan approved/supported by the OEM of the IT hardware/software. The installation team must be certified. The contractor shall ensure that the sizing of servers (VMs, RAM, Cores, storage) SAN, replication and other related installation and configurations are accordance with the approved installation plan.

5 TESTING & COMMISSIONING

The contractor shall make necessary arrangement including tools, access etc for the testing of IT hardware and software as per the requirements. The contractor

shall ensure the testing of critical VMs and data to be online in case of any hardware failure. The reports shall be submitted to the Client after successful completion of testing/commissioning phase.

The disaster recovery site test shall also be performed to make sure that the core objective of IT service to be available in case of Primary site down has been tested.

All the active equipment shall be tested & commissioned by the Contractor as per the approved test/commission plan by the Consultant/Engineer Incharge.

6 TRAINING

The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant. However, two levels of training shall be imparted; user level and administrative/advanced level.

7 DOCUMENTATION

The contractor shall provide technical documentation that includes high- and low-level designs, all layouts, complete labeling scheme, workshop/ shop drawings, network addressing scheme, active equipment configuration detail, as-built drawings, etc. which are necessary for complete installation in light of the tender documents. All user manuals shall also be submitted.

8 WARRANTY & MANAGED SERVICES

The Contractor shall provide comprehensive 1 year onsite warranty and managed services of all active equipment and software support and services. During this period, it will be the responsibility of the Contractor to rectify any defects and provide services such as preventive maintenance, configuration of equipment, problem rectification within the permissible downtime and backup equipment inventory. The necessary patches, upgrades and updates as and when released by the original supplier shall also be provided during the warranty period so as to ensure that the system is functioning to provide the best performance.
Warranty Period shall be started after signing of Handing Over/Taking Over Certificate.

17. SIEM SOLUTION

1 SCOPE

The work under this section consists of supplying, installing, configuring, programming, testing, commissioning, and training all the materials and services of a complete SIEM solution. The system shall be complete in all respects as described in these specifications and B.O.Q.

This specification and description are intended to set out the minimum requirements and it is expressly understood and agreed by the Contractor that anything which is usually furnished as a part of such installation as is called for in this tender and which is necessary for its proper completion, execution, and function shall be furnished as a part of this specification without additional costs and extension of time whether or not shown in details on the drawings or described in particular hereinafter.

The technical documentation to be furnished by the Contractor shall include installation, testing & configuration plans, etc. as necessary for complete installation in light of the tender documents.

2 SYSTEM REQUIREMENTS

2.1 GENERAL

SIEM Solution must support the following features:

a. Data aggregation
b. Security data analytics (reports and dashboards)
c. Correlation and security event monitoring
d. Forensic analysis
e. Incident detection and response
f. Real-time event response or alerting console
g. Threat intelligence
h. User and entity behavior analytics (UEBA)
i. The SIEM should be able to perform cross correlation of SOC and NOC analytics
j. The SIEM should able to offer Out-of-the-Box Compliance Reports like PCI-DSS, HIPAA, SOX, NERC, FISMA, ISO, GLBA, GPG13, SANS Critical Controls, COBIT, ITIL, ISO 27001, NERC, NIST800-53, NIST800-171, NESA
k. Should have 900+ built in rules to detect a wide variety of MITRE techniques
l. Should be perpetual virtualized environment solution to cater below requirements:
   - should be offered in high availibility
   - 50 devices/servers/systems
   - 25 x FIM & Performance Agents for Windows and Linux Servers

- 2000 EPS

m. Data retention and log management for 1 year
- 9 months should be compressed/archieved
- 3 months reamain available online

as per the proposed server & storage and network hardware with complete installation and configuration and one-year comprehensive warranty

Note: The offered SIEM should be from a well-known brand/OEMs and should not be locally or in-house developed.

3 INSTALLATION REQUIREMENTS

Installation of SIEM solution shall require close coordination between the contractor and the Client personnel.

4 TESTING & COMMISSIONING

The contractor shall make necessary arrangements for a scheduled inspection. The reports shall also be submitted to the Client after the successful completion of the testing/commissioning phase.

All the solutions shall be tested & commissioned by the Contractor as per the approved test/commission plan by the Consultant/Engineer In charge.

5 TRAINING

The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant. However, two levels of training shall be imparted; user level and administrative/advanced level.

6 DOCUMENTATION

The contractor shall provide technical documentation which arenecessary for complete installation in light of the tender documents. All user manuals shall also be submitted.

7 WARRANTY & MANAGED SERVICES

The Contractor shall provide comprehensive one-year on-site warranty and managed services the solution.

SECTION – 8378

18. Video Conferencing System

1 SCOPE

The work under this section consists of supplying, installing, configuring, programming, testing, commissioning and training of all material and services of complete Video Conferencing System. The system shall be complete in all respect as described in these specifications, drawings, B.O.Q and in accordance with International Organization for Standardization (ISO) and Telecommunications Industry Association (TIA) recommendations.

The Contractor shall discuss the equipment placement/layout with the Engineer and co-ordinate at site for exact locations and positions of the equipment and routing of cables etc.

The preparation of shop/As Built drawings and low-level design is the responsibility of the Contractor. This specification and description is intended to set out the minimum requirements and it is expressly understood and agreed by the Contractor that anything which is usually furnished as a part of such installation as is called for in this tender and which is necessary for its proper completion, execution and function shall be furnished as a part of this specification without additional costs and extension of time whether or not shown in details on the drawings or described in particular hereinafter.

The technical documentation to be furnished by the Contractor shall include installation, testing & configuration plans, shop drawings, material/equipment submittals, as-built drawings, etc. as necessary for complete installation in light of the tender documents.

2 SYSTEM REQUIREMENTS

2.1 GENERAL

The video conferencing system shall be used for remote participation in Judiciary Court hearing and other related purposes. Keeping in view the importance of efficient and effective video communication System, a system shall be designed surrounded everyone with the rich, legendary sound with stereo speakers that deliver immersive, room filling audio with microphone. System shall be compatible with other online meeting solutions. Logical diagram of Video Conferencing System is shown in Figure 1.1.

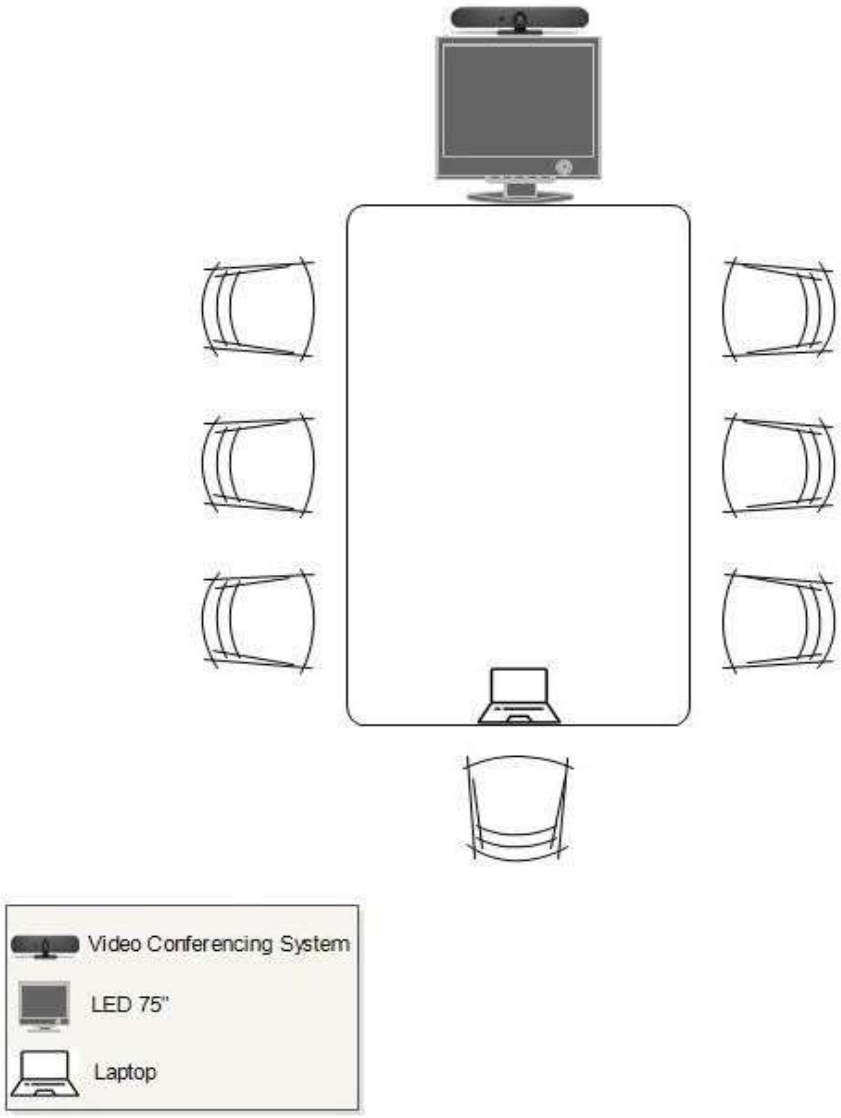


Figure: Logical Drawing of Microphone Conferencing System

3 ACTIVE & PASSIVE COMPONENT DETAIL

3.1 VIDEO CONFERENCE SYSTEM

Standard based Video (H.323, H.264 AVC, H.264 High Profile, H.265, H.239 and SIP), Audio pickup range 25 ft or higher, Camera minimum 12x digital zoom, UHD 1080P 120º capture, automatic group framing, automatic speaker framing, presenter mode, Resolution 1080P 1024kbps, minimum 2 x HDMI display supported, Integrated MIC and Speakers, Noise block AI, Built-in operating system, built-in WiFi, IPv4 and IPv6 support, Minimum 1x 1G Ethernet port, Web proxy support.

Authenticated access to admin menus, web interface and API, Interoperability,

support and license for all other applications including zoom, Microsoft Teams, Skype, Microsoft Lync, Blue Jeans, Dial pad, GoToRoom, Ring Central and same, Intuitive touch interface for easy access to conferencing solution for join call, content sharing, adjust camera and change participant layouts, USB connection to PC or MAC for video calls

3.2 SMART DISPLAY

LED UHD Smart Display, Size minimum 75", Display Resolution 3840x2160, Operating System Android, Contrast ratio minimum 5000:1, Refresh rate 60, Integrated Speakers, Internet link 2.4Ghz/5Ghz dual-band Wi-Fi, Ethernet Network (RJ45), minimum 02 x HDMI ports, USB port, A/V IN port, Headphone support available

3.3 LAPTOP

Laptop dedicated for video conference system, core i7 with latest generation, 16GB RAM, minimum 512 GB SSD, 15.6' Display, Licensed windows 10 or higher

3.4 UNINTERPRETED POWER SUPPLY (UPS)

1.5 KVA online UPS with dry batteries dedicated for the video conference system

4 APPLICABLE STANDARDS AND CODES

The latest editions of the following standards/codes shall be applicable for the materials covered within the scope of this section:

Video Standards & Protocols:
H.264 AVC, H.264 High Profile, H.264, H.239

Security:
Media Encryption (H.323, SIP)

5 DRAWINGS (SHOP, AS-BUILT)

The contractor shall prepare shop drawings to indicate location of the equipment, cable etc. keeping in view the actual site conditions and submit for approval prior to start of cable laying process. As-built drawings shall be prepared by the Contractor after the successful testing of the system.

6 INSTALLATION REQUIREMENTS

Installation of all equipment shall require close coordination between the contractor and the Client personnel. The equipment placement with power supply scheme shall be submitted for Consultant/Engineer Incharge's approval. The contractor shall ensure that the cabling and mounting of installed equipment shall be done in accordance with the industry standards and

supported by the Original Equipment Manufacturer (OEM).

7 TESTING & COMMISSIONING

The contractor shall make necessary arrangement including tools, access etc. for scheduled site inspections. Testing of the system shall be conducted by the Contractor as per the approved test/commission plan by the Consultant/Engineer In charge. The reports shall be submitted to the Client after successful completion of testing/commissioning phase.

8 TRAINING

The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant. However, two levels of training shall be imparted; user level and administrative/advanced level.

9 DOCUMENTATION

The contractor shall provide technical documentation that includes the operating procedure, complete labeling scheme, network addressing scheme, equipment configuration detail, as-built drawings, etc. which are necessary for complete installation in light of the tender documents. All user manuals shall also be submitted.

10 WARRANTY & MANAGED SERVICES

The Contractor shall provide comprehensive one year onsite warranty and managed services of all active equipment. During this period, it will be the responsibility of the Contractor to rectify any defects and provide services such as preventive maintenance, configuration of equipment, problem rectification within the permissible downtime and backup equipment inventory. The necessary patches, upgrades and updates as and when released by the original supplier shall also be provided during the warranty period so as to ensure that the system is functioning to provide the best performance. Warranty period shall start from the signing date of Handing Over/Taking Over certificate.

SECTION-8384

19. ESTABLISHMENT OF WLAN

1.0 SCOPE OF WORK

The work under this section consists of supplying, installation, testing and commissioning of all equipment, material, accessories and services of WLAN System. These shall be complete in all respect as described in these specifications, drawings, B.O.Q and in accordance with International Organization for Standardization (ISO) and Telecommunications Industry Association (TIA) recommendations.

The Contractor shall discuss the cabling layout with the Engineer and co-ordinate at site for exact locations and positions of the APs. Contractor shall conduct the detailed survey of the building to identify the number of Access Point, their exact location and value of Received Signal Strength Indication (RSSI) at various points in the coverage area.

The preparation of shop/As Built drawings & low level design is the responsibility of the Contractor. This specification and description is intended to set out the minimum requirements and it is expressly understood and agreed by the Contractor that anything which is usually furnished as a part of such installation as is called for in this tender and which is necessary for its proper completion, execution and function shall be furnished as a part of this specification without additional costs and extension of time whether or not shown in details on the drawings or described in particular hereinafter.

The technical documentation to be furnished by the Contractor shall include installation, testing & configuration plans, shop drawings, material/equipment submittals, as-built drawings, etc. as necessary for complete installation in light of the tender documents.

2.0 SYSTEM REQUIREMENTS

General

A Wireless Network shall be installed to provide connectivity to mobile users in the specified area of the building.

The Wi-Fi infrastructure shall be compliant with IEEE 802.11ax with backward compatibility with IEEE 802.11 a/b/g/n/ac/ax Wave 2. Access Points (APs) shall have two radios capable of simultaneously working on two frequency bands i.e., 2.4 GHz and 5 GHz.

All the APs shall be connected to the PoE-based access switches, which shall have sufficient power per port for the APs dual-band operation. APs shall have Gigabit connectivity with PoE-based Access switches.

The location of APs and their relative coverage zone is given below in the Table 1.1.

Sr. No.	Name of AP	Locations	No. of Offices
Ground Floor			
1.	AP-GF-01	Conference Room	1
2.	AP-GF-02	Meeting Room	1
3.	AP-GF-03	Data Center	1
First Floor			
4.	AP-FF-01	Library Hall /Conference Room	1
Third Floor			
5.	AP-TF-01	Class Room	1
6.	AP-TF-02	Class Room	1
7.	AP-TF-03	Class Room	1
8.	AP-TF04	Class Room	1

Table 1.1: Location of Access Points (APs) and their Coverage Zone

3.0 ACTIVE COMPONENT DETAIL

3.1 ACCESS POINT with WLAN Controller

Compliance with IEEE 802.11ax and compatibility with IEEE 802.11 a/b/g/n/ac/ac Wave 2, Provides service on Tri-bands 2.4 GHz and 5 GHz bands and independent radio scanning, at a rate of 5.95 Gbps at least 570 Mbps at 2.4 GHz (2x2), at least 2.4 Gbps at 5 GHz (4x4), Must have 2x GE Ports, Built-in Omni directional antennas, Support 802.11k and 802.11v smart roaming, PoE+, Support WEP authentication/encryption, WPA2-PSK authentication and encryption, WPA2-802.1X authentication and encryption, Support at least 500 users per Radio, Built in controller, support 802.1x authentication and MAC address authentication and with complete installation, testing & commissioning and one year comprehensive warranty. Warranty Period shall start after signing of Handing Over/Taking Over Certificate.

Hardware based WLAN controller (Qty=01) should support at-least 1000 access terminals and 250 network devices, Should support user authentication such as

802.1X authentication, MAC address authentication, Portal authentication, VPN authentication, and PPSK/DPSK authentication, Can automatically identify terminal types, vendors, and OSs, Support terminal identification such as MAC OUI, DHCP Option, LLDP and proactive modes such as SNMP, Can detect rogue APs and terminals in WIDS/WIPS mode and force them to go offline, Should support NAC solution, Support Default/ customized Dashboard with trend and statistic, Perpetual licenses for all quoted wireless access points must be included.

4.0 APPLICABLE CABLING STANDARDS

The WLAN cabling shall be done in accordance with the following standards:
TIA/EIA 568-B.1, B.2, B.3: Telecommunications Cabling Standard
TIA/EIA 569-A: Commercial Pathways and Spaces
TIA/EIA 606: Standard for Telecom Infrastructure
ITA/EIA 758: Outside Plant Cabling Standard
SO/IEC 11801: Generic Cabling for Customer Premises

2.0 DRAWINGS (SHOP, AS-BUILT)

The contractor shall prepare shop drawings to indicate location of Wireless Access Points and cable routes etc. keeping in view the actual site conditions and submit for approval prior to start of cable laying process. As-built drawings shall be prepared by the Contractor after the successful testing of the cabling infrastructure.

3.0 INSTALLATION REQUIREMENTS

Installation of all equipment shall require close coordination between the contractor and the Client personnel. The Wireless Access Points (APs) exact location detail shall be submitted for Consultant/Engineer Incharge's approval. The contractor shall ensure that the cabling and crimping/termination of installed equipment shall be done in accordance with the industry standards and supported by the Original Equipment Manufacturer (OEM).

4.0 TESTING & COMMISSIONING

The contractor shall make necessary arrangement including tools, access etc for scheduled site inspections. The reports shall be submitted to the Client after successful completion of testing/commissioning phase.

All the active equipment shall be tested & commissioned by the Contractor as per the approved test/commission plan by the Consultant/Engineer Incharge.

5.0 TRAINING

The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant. However, two levels of training shall be imparted; user level and administrative/advanced level.

6.0 DOCUMENTATION

The contractor shall provide technical documentation that includes all layouts, complete labeling scheme, workshop/ shop drawings, active equipment configuration detail, as-built drawings, etc. which are necessary for complete installation in light of the tender documents. All user manuals shall also be submitted. The Contractor shall also provide step by step detail of all configurations made in soft form and in hard form.

7.0 WARRANTY & MANAGED SERVICES

The Contractor shall provide comprehensive one year onsite warranty and managed services of all active equipment. During this period, it will be the responsibility of the Contractor to rectify any defects and provide services such as preventive maintenance, configuration of equipment, problem rectification within the permissible downtime and backup equipment inventory. The necessary patches, upgrades and updates as and when released by the original supplier shall also be provided during the warranty period so as to ensure that the system is functioning to provide the best performance.

SECTION – 8341

20. AUDIO VIDEO SYSTEM (for Auditorium)

SCOPE OF WORK

The scope of work for the Audio Video System for the auditorium includes the supply, installation, connection, configuration, and programming, testing, commissioning, and training of all equipment, material, accessories, and services. The contractor is responsible for procuring and installing the necessary components of the system. They will establish connections, configure the system, and program it according to the specific requirements of the auditorium. Thorough testing will be conducted to ensure the system's functionality and performance before commissioning it for regular operation. The contractor will provide training to the auditorium staff on operating and maintaining the system. Collaboration with the Engineer is essential to discuss the system layout, determine the routes and locations of electrical and telecommunication lines, and coordinate on-site. The Audio Video System, along with its accessories, must comply with ISO standards and relevant contractual provisions.

GENERAL

The Audio Video System, as depicted in the drawings, will be provided in accordance with the specifications. All active components of the system should be products from a single manufacturer. The system should incorporate a modular design to facilitate future enhancements.

The contractor is required to submit Sound Pressure Level (SPL) calculations for speaker review. The calculation should consider a background noise level of 75-80 dB, and a feedback circuit arrangement should be implemented to maintain sound pressure levels at least 10 dB above the background noise. A supervisory system should be in place to monitor the loudspeaker loop for open circuits, short circuits, and earth leakage conditions.

Announcement facilities are required at the Control Room next to Auditorium at fourth floor of the Main Building. All equipment, cables, and wires should be numbered according to the standardization procedures outlined in IEC 750. The contractor must confirm in writing their compliance with the specifications, providing a qualified statement of compliance.

Materials provided under this specification should be standard products from manufacturers regularly involved in producing such equipment. The manufacturer should also have an authorized representative in Pakistan for equipment maintenance.

The provision of junction boxes and glands, if required, should be included in the respective Bill of Quantities (BOQ) item and priced accordingly.

APPLICABLE STANDARDS AND CODES

EN54, CE, DIN EN 60268-5 and DIN 45589 shall be applicable for the material covered within the scope of this section.

MATERIALS

High-Resolution Projector Specifications

Projector with input and output as shown on the drawing and required as per manufacturer's recommendation shall be provided and shall have the following minimum characteristics:

Specification	Details
Resolution	Full HD (1920x1080 pixels) and above
ANSI Lumens Rating	8000 and above
Contrast Ratio	1000:1 and above
Throw Ratio	1.5:1 and above
Zoom	1.2x and above
Connectivity	HDMI, VGA, USB, Wireless
Recommended Use	Conference room
Lamp Life	Up to 5000 hours (normal mode) and above
Noise Level	35 dB (Normal Mode), 29 dB (Eco Mode)

Projection Screen Specifications

Required as per manufacturer's recommendation shall be provided and shall have the following minimum characteristics:

Specification	Details
Screen Type	Motorized
Screen Size	26' x 15' (Width x Height)
Aspect Ratio	16:9
Gain	1.0 or higher
ANSI/Info Comm Compliance	Yes
Installation Options	Ceiling-mounted

Specification	Details
Control Options	Remote control / wall switch

Audio Mixer Specifications

Required as per manufacturer's recommendation shall be provided and shall have the following minimum characteristics:

Specification	Details
Mixer Type	Professional-grade audio mixer
Input Channels	Minimum of 12 input channels
Digital Audio Standards Compliance	AES and EBU
EQ Control	Individual channel EQ control
Gain Control	Individual channel gain control
Audio Inputs	Yes
Audio Outputs	Yes
Effects Processing	Built-in effects processing
Mixing Modes	Stereo / Mono / Surround Sound
Digital Connectivity	USB, Ethernet, MIDI

Amplifier Specifications

Required as per manufacturer's recommendation shall be provided and shall have the following minimum characteristics:

Specification	Details
Amplifier Type	Power amplifier
Power Output	Minimum of 100 watts per channel
Total Harmonic Distortion (THD)	Less than 0.1%
Safety Standards Compliance	UL or CE (Specify relevant safety standards)

Speaker Specifications

Loudspeaker suitable for mounting on wall brackets shall be used wherever required. Speakers shall be installed with junction box, ceiling rose, driver unit, glands, integrated 100 V-matching transformers.

Required as per manufacturer's recommendation shall be provided and shall have the following minimum characteristics:

Specification	Details
Speaker Type	High-quality speakers
Coverage Pattern	[Specify coverage pattern (e.g., 90° x 60°)]
Power Handling Capacity	15W-60W
Frequency Response	120Hz-15kHz
Sensitivity	97 (dB) 1W, 1m
Mounting Options	Wall mounted
SPL (Sound Pressure Level)	97 SPL rating (dB)
Compliance with AES and EIA Standards	Yes
Application	Sound reinforcement system

Microphone Specifications

Microphone shall have the following characteristics:

Specification	Details
Microphone Type	Wired and wireless microphone
Audio Reproduction	Clear and intelligible audio reproduction
Frequency Response Range	100Hz to 20kHz
Signal to Noise Ratio (S/N)	≥ 60 dB

Audio Processor Specifications

Required as per manufacturer's recommendation shall be provided and shall have the following minimum characteristics:

Specification	Details
Audio Processor Type	Audio processor with built-in DSP
Digital Signal Processing (DSP)	Yes
Equalization Capabilities	Built-in equalization capabilities

Specification	Details
Compression Capabilities	Built-in compression capabilities
Compliance with AES and EBU Standards	Yes
Dynamic Range Processing	Yes/No (Specify if dynamic range processing is available)
Presets and Memory	Preset configurations and memory storage
Control Interface	Physical knobs, buttons, or digital interface
Display	Built-in display for visual feedback
Rack Mountable	Yes

Multimedia Player Specifications

Required as per manufacturer's recommendation shall be provided and shall have the following minimum characteristics:

Specification	Details
Player Type	Multimedia player
Disc Compatibility	DVDs, Blu-ray discs
Video Formats Supported	Yes
Audio Formats Supported	Yes
Video Output Resolutions	[High resolutions]
HDMI Version	HDMI 2.0
HDCP Compliance	HDCP 2.2
Media Playback Options	USB, SD card, Network streaming, etc.
Networking Capabilities	Wi-Fi, Ethernet
Digital Audio Output	HDMI, optical
Analog Audio Output	RCA, 3.5mm
Video Output Connections	HDMI, RCA

Specification	Details
Audio Output Connections	HDMI, RCA
Remote Control	Remote control with essential playback functions
USB Ports	Yes
Network Connectivity	Yes

Audio-Video Switcher Specifications

Required as per manufacturer's recommendation shall be provided and shall have the following minimum characteristics:

Specification	Details
Switcher Type	AV switcher with multiple HDMI inputs and outputs
HDMI Inputs	Yes
HDMI Outputs	Yes
HDCP Support	Yes
HDMI Standards Compliance	HDMI
EDID (Extended Display Identification Data)	Yes
Video Resolutions Supported	Yes
Audio Formats Supported	Yes
Control Options	Remote control, front panel buttons, RS-232, Ethernet, etc.
Audio Return Channel (ARC) Support	Yes
CEC (Consumer Electronics Control) Support	Yes
Video Processing	[Specify video processing features]
Rack Mountable	Yes

TRAINING

A training session shall be presented by a fully qualified, trained representative of the equipment manufacturer/supplier who is thoroughly knowledgeable of the specific installation. The training shall be given to personnel responsible for operation and maintenance of the system.

INSTALLATION

Audio Video System Equipment

The installation of Audio Video System Equipment shall be in strict accordance with the manufacturer's instructions/recommendations and these specifications.

The testing of Audio Video System equipment shall be in compliance with the relevant standards and regulations. During testing of equipment, emphasis shall be laid on the following:

Wiring and Cabling

Wiring and cabling of Audio Video System shall be carried out as per instructions given in Section 8212 'Low Tension Cables' of these specifications.

Conduits and Accessories

Conduits and accessories for Audio Video System shall be installed as per instructions given in section 'Conduits and Pipes', of contact specifications.

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21. IP-Based Surveillance System for Outdoor Bullet Camera

An IP-based surveillance system shall be deployed at the Sindh Forensic Science Laboratory to strengthen perimeter security and outdoor monitoring. Outdoor bullet cameras shall be installed at designated locations to ensure continuous visual coverage of key external areas.

The system shall utilize network-connected IP cameras, enabling high-resolution video capture, remote access, and centralized storage. Cameras shall be equipped with weatherproof housing and infrared night vision to ensure round-the-clock surveillance in varying environmental conditions. All recorded footage shall be managed through an integrated Network Video Recorder (NVR) system.

Technical Specifications:

- **Outdoor Bullet Camera Type I**

IP Based POE outdoor Bullet Camera with 4 Mega Pixel resolution (2560 × 1440), Progressive Scan CMOS, minimum built-in IR distance up to 50 meter, varifocal motorized lens from 2.7 mm to 12 mm, 25/30 fps @ 4MP, H.264/H.265 compression, WDR, Back light Compensation (BLC), High Light Compensation (HLC),Intrusion, tripwire, Motion Detection, Automatic Gain Control (AGC),Video tempering, audio detection, Weather proof IP 67 rated, Operating Temperature -10°C to +55°C with junction box size 4x4 and complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

- **Boundary Wall Camera Type II**

IP Based POE outdoor Bullet Camera with 4 Mega Pixel resolution (2560 × 1440), Progressive Scan CMOS, 4MP (2688 × 1520)@30fps, minimum built-in IR distance up to 50 meter, 3.6 mm fixed lens, H.265/H.264, compression, WDR, High Light Compensation (HLC), Back light Compensation (BLC), Automatic Gain Control (AGC), Intelligent detection: Intrusion, tripwire crossing, Motion detection, Video tempering, Weather proof IP 67 rated, Operating Temperature -10°C to +55°C with junction box size 4x4 and complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

- **PTZ Camera Type III**

IP Based PTZ Camera with 4 Mega Pixel resolution (2560 × 1440), minimum built-in IR distance 200 meter, 40 X or more optical Zoom, Pan Range: 360º, Tilt Range: Between -10° to 90°, 500 presets or more, H.264 and H.265 video/audio compression, WDR,

Back light Compensation (BLC), High Light Compensation (HLC), Motion detection, Video tampering, Network disconnection, Automatic Gain Control (AGC), audio detection, Auto tracking, Privacy masking up to 20 areas or more, Weather proof IP 66 rated, ONVIF support, Operating Temperature -10°C to +60°C with junction box size 6x4 and power adapter, complete installation, configuration & testing and with one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

- **8 Port PoE Industrial Switch (Type I) (For CCTV and PIDS)**

Fixed configuration PoE enabled manageable layer-3 switch, 8-Ports 10/100/1000 Mbps RJ-45 interface for camera connectivity over UTP, 2 dual 1G Ports for uplink connectivity (SFP Interface), 802.3af/at compliant built-in power supply, support PoE cameras on all 8 ports up to 12.95 watts power simultaneously, on all 8 ports up to 15 watts power simultaneously,MAC address entries should be 8k or higher, 2 GB RAM, power cable, IP40 rated with installation, configuration & testing with standard manufacturer warranty.

- **8 Port UPoE Industrial Switch (Type II)**

Fixed configuration UPoE enabled manageable layer-3 switch, 8-Ports 10/100/1000 Mbps RJ-45 interface for camera connectivity over UTP, 2 dual 1G Ports for uplink connectivity (SFP Interface), MAC address entries should be 8k, 802.3bt Type 3 compliant redundant power supplies, support UPoE cameras on all 8 ports up to 60 watts' power simultaneously, power cable, IP40 or higher rated with installation, configuration & testing with standard manufacturer warranty.

- **UTP CABLE CAT 6A**

The user access will be provided through structured category 6A or higher Unshielded Twisted Pair (UTP) cable which will provide secure, reliable and high-speed data communication and information sharing mechanism. All the cables within the coverage zone of a specific switch will converge to a data cabinet. In addition to Access Switch, this cabinet shall house UTP Patch Panel, Fiber Patch Panel and UPS. Proper cabinet cabling will be done using cable managers, cable ties, etc. Data Cabinets will be secured from unauthorized access by providing lock and key. Data and power cables shall be installed in separate cable trays/PVC conduits. Proper labeling of passive equipment shall also be done to facilitate network management. Stack cables will be provided for the stacking. Faceplate shattered (duplex and simplex) along with all required equipment (I/O and backbox) will be provided as per the provided plan.

The LAN cable also provides network access to Multimedia Projector, Employee

Attendance System and Video Conferencing System.

The switching and cabling infrastructure for the Access Control System will be part ofthis Local Area Network system.

- **APPLICABLE STANDARDS AND CODES**

The latest editions of the following standards/codes shall be applicable for the materials covered within the scope of this section:

TIA/EIA 568-B.1, B.2, B.3:	Telecommunications Cabling Standard
TIA/EIA 569-A:	Commercial Pathways and Spaces
TIA/EIA 606:	Standard for Telecom Infrastructure
ISO/IEC 11801:	Generic Cabling for Customer Premises

- **DRAWINGS (SHOP, AS-BUILT)**

The contractor shall prepare shop drawings to indicate location of IT equipment, cable routes etc. keeping in view the actual site conditions and submit for approval prior to start of cable laying process. As-built drawings shall be prepared by the Contractor after the successful testing of the cablinginfrastructure.

- **INSTALLATION REQUIREMENTS**

Installation of all equipment shall require close coordination between the contractor and the Client personnel. The data cabinet sizing, its exact location & power supply scheme shall be submitted for Consultant/Engineer Incharge's approval. The contractor shall ensure that the cabling and crimping/termination of installed equipment shall be done in accordance with the industry standards and supported by the Original Equipment Manufacturer (OEM).

- **TESTING & COMMISSIONING**

The contractor shall make necessary arrangement including tools, access etc for scheduled site inspections. Fluke testing of UTP & fiber links shall be conducted by the Contractor as per the approved test/commission plan by the Consultant/Engineer Incharge. The reports shall be submitted to the Client after successful completion of testing/commissioning phase.

All the active equipment shall be tested & commissioned by the Contractor as per the approved test/commission plan by the Consultant/Engineer Incharge.

- **TRAINING**

  The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant. However, two levels of training shall be imparted; user level and administrative/advanced level.

- **DOCUMENTATION**

  The contractor shall provide technical documentation that includes all layouts, complete labeling scheme, workshop/ shop drawings, network addressing scheme, active equipment configuration detail, as-built drawings, etc. which are necessary for complete installation in light of the tender documents. All user manuals shall also be submitted.

- **WARRANTY & MANAGED SERVICES**

  The Contractor shall provide comprehensive one-year on-site warranty and managed services of all active equipment. During this period, it will be the responsibility of the Contractor to rectify any defects and provide services such as preventive maintenance, configuration of equipment, problem rectification within the permissible downtime and backup equipment inventory. The necessary patches, upgrades and updates as and when released by the original supplier shall also be provided during the warranty period so as to ensure that the system is functioning to provide the best performance. Warrantyperiod shall be started after signing of Handing Over/Taking Over Certificate.
  The Contractor shall provide 20 years warranty for the LAN cablinginfrastructure.

SECTION – 8381

22. BAGGAGE SCANNING MACHINES

1 SCOPE

The work under this section consists of supplying, installing, configuring, testing, commissioning and training of all material and services of Baggage Scanning Machines. The system shall be complete in all respect as described in these specifications, drawings and B.O.Q.

The Contractor shall co-ordinate with the Engineer at site for exact locations and positions of the Baggage Scanning Machines.

The preparation of shop/As Built drawings and low level design is the responsibility of the Contractor. This specification and description is intended to set out the minimum requirements and it is expressly understood and agreed by the Contractor that anything which is usually furnished as a part of such installation as is called for in this tender and which is necessary for its proper completion, execution and function shall be furnished as a part of this specification without additional costs and extension of time whether or not shown in details on the drawings or described in particular hereinafter.

The technical documentation to be furnished by the Contractor shall include installation, testing & configuration plans, shop drawings, material/equipment submittals, as-built drawings, etc. as necessary for complete installation in light of the tender documents.

2 SYSTEM REQUIREMENTS

2.1 GENERAL

Baggage Scanning Machines with minimum steel penetration equipped with latest technology shall be proposed for the screening of brief cases and hand bags. Machines shall be installed at the main entrance of Sindh Forensic Science Laboratory and at the main reception of Main Building.

2.2 BAGGAGE SCANNING MACHINE SYSTEM INFRASTRUCTURE

It shall comply with EC regulations and international standards related to electrical safety and electromagnetic compatibility. All Baggage Scanning Machines shall be provided power through UPS units of 3 KVA size.

3 ACTIVE COMPONENT DETAIL

3.1 BAGGAGE SCANNING MACHINE

Tunnel size – 24.2 inches (width) x 16.7 inches (height), Conveyor belt speed should be 42 ft per minute or more, Conveyor Load Capacity 165 kg or more, L – shaped detector, The X-ray beam divergence should be complete image without corner cuts, edge trace/edge sharpening, Machines should operate on 220 VAC +/- 10%, 50/60 Hz power supply and should be able to with stand voltage fluctuations, X-ray Generator Tube voltage – 150 KV or more, Duty cycle – 100%, The radiation level should not exceed accepted health standard (0.1 mR/Hr at a distance of 5cm). Relevant certificate of federal standard regulations, The operating temperature normally should be 0 degree C to +40 degree C, Humidity – 90% non-condensing, Resolution – the machine resolution should be 40 AWG or more, Penetration should be 40mm thickness of steel (standard) or more, Continues electronic zoom facility should be available to magnify the chosen area of an image 32X or more , Video Display – 24 Inches Touch LCD With 1920 X1080 Resolution display, 3D Image Technology, Linux based System, All suspicious items (Explosives, High density material) should be displayed in one mode, Radiation Safety - The machine must comply with requirements of health and safety regulations with regard to mechanical electrical and radiation hazards. Before installation of the machine, the supplier/manufacturer should furnish relevant certificate from Atomic Energy Regulatory Board of Pakistan regarding radiation safety. The company manufacturing the equipment should have ISO certification for manufacturing and servicing of X-ray Screening machines, Film Safety - Guaranteed safety for high-speed films up to ISO1600. The machines should be film safe, rodent protected, Dust proof cover is to be provided for covering when system is not in use, Facility for variable contrast must be incorporated to allow enhancement of lighter and darker portion of the image, Machine should be capable for recalling previous images, It should have the capability of archiving images with date and time stamp, Images can be recorded in to any removable drive with complete installation, testing & commissioning and with minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

3.2 UPS 3 KVA

UPS of size 3KVA with 10 minutes battery backup shall be installed with complete installation & testing and minimum one year comprehensive warranty or warranty provided by Principal Manufacturer whichever is on higher side.

4 APPLICABLE STANDARDS AND CODES

The latest standards/codes shall be applicable for the materials covered within the scope of this section

5 DRAWINGS (SHOP, AS-BUILT)

The contractor shall prepare shop drawings to indicate location of Baggage Scanning Machines. As-built drawings shall be prepared by the Contractor after the successful deployment of machines.

6 INSTALLATION REQUIREMENTS

Installation of all equipment shall require close coordination between the contractor and the Client personnel. Baggage Scanning Machine's exact location shall be submitted for Consultant/Engineer Incharge's approval.

7 TESTING & COMMISSIONING

The contractor shall make necessary arrangement including tools, access etc. for scheduled site inspections. The reports shall be submitted to the Client after successful completion of testing/commissioning phase.

All the active equipment shall be tested & commissioned by the Contractor as per the approved test/commission plan by the Consultant/Engineer Incharge.

8 TRAINING

The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant. However, two levels of training shall be imparted; user level and administrative/advanced level.

9 DOCUMENTATION

The contractor shall provide technical documentation that includes all layouts, complete labeling scheme, workshop/ shop drawings, active equipment configuration detail, as-built drawings, etc. which are necessary for complete installation in light of the tender documents. All user manuals shall also be submitted.

10 WARRANTY & MANAGED SERVICES

The Contractor shall provide comprehensive one year on site warranty and managed services of all active equipment. During this period, it will be the responsibility of the Contractor to rectify any defects and provide services such as preventive maintenance, configuration of equipment, problem rectification within the permissible downtime and backup equipment inventory. The necessary patches, upgrades and updates as and when released by the original supplier

shall also be provided during the warranty period so as to ensure that the system is functioning to provide the best performance.

SECTION – 8384

23. WALK THROUGH GATES

1 SCOPE

The work under this section consists of supplying, installing, configuring, testing, commissioning and training of all material and services of Walk Through Gates. The system shall be complete in all respect as described in these specifications, drawings and B.O.Q.

The Contractor shall discuss the Equipment layout with the Engineer and co-ordinate at site for exact locations and positions of the Walk through Gates.

This specification and description is intended to set out the minimum requirements and it is expressly understood and agreed by the Contractor that anything which is usually furnished as a part of such installation as is called for in this tender and which is necessary for its proper completion, execution and function shall be furnished as a part of this specification without additional costs and extension of time whether or not shown in details on the drawings or described in particular hereinafter.

The technical documentation to be furnished by the Contractor shall include installation, testing & configuration plans, shop drawings, material/equipment submittals, as-built drawings, etc. as necessary for complete installation in light of the tender documents.

2 SYSTEM REQUIREMENTS

2.1 GENERAL

Multi- Zone pin pointing walkthrough gates equipped with latest technology shall be installed for weapon screening. It shall be installed in the following locations:

Sr. No	Location	No. of Walk through Gates
1.	Main Entrance of Sindh Forensic Science Laboratory	01
2.	Reception of Main Building	01

2.2 WALK THROUGH GATES SYSTEM INFRASTRUCTURE

It shall have multiple zone detection with high accuracy rate. Each zone shall be independently set with different sensitivity range. It shall comply with EC regulations and international standards related to electrical safety and electromagnetic compatibility.

3 ACTIVE COMPONENT DETAIL

3.1 WALK THROUGH GATES

Minimum 32 zone detection, consist of a free standing walk-through frame with an integral control unit, suitable to detect metallic objects on a person by means of the magnetic field principle, weather proof, suitable to detect ferrous and non-ferrous metals, Multiple horizontal zones of detection each with independent sensitivity adjustments, sensitivity of each zone can be adjusted from –99% to +99% in steps of 1%, A processor based continuous wave multiple sensor measurement method with self-testing diagnostics and high stability digital signal processing, Transmitter and receiver sensor elements positioned in both side panels and that scan both sides of the person being screened, tamper proof, Detection circuitry that remains permanently active and cannot be switched or programmed to a non-continuously active state, No photo-optic device that deactivates the detection or alarm circuitry, or permits a targeted weapon or object to be passed, slid or tossed through the detector undetected, Security on/off key lock and two 4 or 6 digit user selectable pass-codes, Standard user selectable detection programs designed to enhance discrimination and minimize orientation affect, metal detector shall not be adversely affected by stationary metal bars or structures in the vicinity of the unit or moving metal near the archway, capable of operating adjacent to an X-Ray inspection unit, The operation of the metal detector shall not be adversely affected by repositioning of the frame within certain limits of its original adjusted position, The unit shall be able to execute a full body scan and detect metal objects down to the lower feet level within the settings specified, The system shall operate by means of automatic level control adjustable to environmental changes without the need to reset, The sensitivity settings shall be consistent at average walking speed, Low intensity magnetic field that is safe for users of heart pacemakers, implanted defibrillators, pregnant women and magnetic storage media, The detectors shall be designed for connection to a 220V +/-5%, 50Hz, single phase, three wire (phase, neutral and earth) power supply, The system shall accept a passage of at least 50 persons per minute without functional overload, Wheel for detector mobility, Comply with EC Regulations and international standards relating to electrical safety and electromagnetic compatibility (EMC), UPS support for minimum 10 minutes backup with complete installation, configuration & testing and with one year comprehensive warranty And as approved by Consultant/Engineer In-charge.

3.2 UPS 2 KVA

2 KVA UPS with support for minimum 10 minutes backup shall also be installed along with Walk through gates.

4 APPLICABLE STANDARDS AND CODES

The latest editions of the following standards/codes shall be applicable for the materials covered within the scope of this section:

TIA/EIA 568-B.1, B.2, B.3:	Telecommunications Cabling Standard
TIA/EIA 569-A:	Commercial Pathways and Spaces
TIA/EIA 606:	Standard for Telecom Infrastructure
ITA/EIA 758:	Outside Plant Cabling Standard
ISO/IEC 11801:	Generic Cabling for Customer Premises
DIN 40040:	Class and Reliability of Units in Telecommunication

5 DRAWINGS (SHOP, AS-BUILT)

The contractor shall prepare shop drawings to indicate location of Walk through Gates. keeping in view the actual site conditions and submit for approval prior to start of cable laying process. As-built drawings shall be prepared by the Contractor after the successful testing of the cabling infrastructure.

6 INSTALLATION REQUIREMENTS

Installation of all equipment shall require close coordination between the contractor and the Client personnel. Walk through Gates exact location shall be submitted for Consultant/Engineer Incharge's approval. The contractor shall ensure that the cabling and crimping/termination of installed equipment shall be done in accordance with the industry standards and supported by the Original Equipment Manufacturer (OEM).

7 TESTING & COMMISSIONING

The contractor shall make necessary arrangement including tools, access etc. for scheduled site inspections. The reports shall be submitted to the Client after successful completion of testing/commissioning phase.

All the active equipment shall be tested & commissioned by the Contractor as per the approved test/commission plan by the Consultant/Engineer Incharge.

8 TRAINING

The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant. However, two levels of training shall be imparted; user level and administrative/advanced level.

9 DOCUMENTATION

The contractor shall provide technical documentation that includes all layouts, complete labeling scheme, workshop/ shop drawings, active equipment configuration detail, as-built drawings, etc. which are necessary for complete installation in light of the tender documents. All user manuals shall also be submitted.

10 WARRANTY & MANAGED SERVICES

The Contractor shall provide comprehensive one year on site warranty and managed services of all active equipment. During this period, it will be the responsibility of the Contractor to rectify any defects and provide services such as preventive maintenance, configuration of equipment, problem rectification within the permissible downtime and backup equipment inventory. The necessary patches, upgrades and updates as and when released by the original supplier shall also be provided during the warranty period so as to ensure that the system is functioning to provide the best performance.

SECTION – 8378

24. UNDER VEHICLE SURVEILLANCE SYSTEM (UVSS)

1 SCOPE

The work under this section consists of supplying, installing, configuring, testing, commissioning and training of all material and services of complete Under Vehicle Surveillance System (UVSS). The system shall be complete in all respect as described in these specifications, drawings and B.O.Q.

The Contractor shall discuss the cabling layout with the Engineer and co-ordinate at site for exact locations and positions of the Under Vehicle Surveillance System equipment and routing of cables etc.

The preparation of shop/As Built drawings and low level design is the responsibility of the Contractor. This specification and description is intended to set out the minimum requirements and it is expressly understood and agreed by the Contractor that anything which is usually furnished as a part of such installation as is called for in this tender and which is necessary for its proper completion, execution and function shall be furnished as a part of this specification without additional costs and extension of time whether or not shown in details on the drawings or described in particular hereinafter.

The technical documentation to be furnished by the Contractor shall include installation, testing & configuration plans, shop drawings, material/equipment submittals, as-built drawings, etc. as necessary for complete installation in light of the tender documents.

2 SYSTEM REQUIREMENTS

2.1 GENERAL

State of the art Under Vehicle Scanning System shall be installed to scan each vehicle entering the Sindh Forensic Science Laboratory thus providing the first line of defense to detect explosive material hidden underneath vehicles. The main entrance will be equipped with this system.

2.2 UNDER VEHICLE SURVEILLANCE SYSTEM INFRASTRUCTURE

In this system, the incoming vehicles will initiate the scanning process at the ramp which will be installed at the entrance. The high resolution camera shall capture the underside view of entire vehicle while the vehicle is moving over the ramp. The image of all vehicles shall be displayed on LED and shall be digitally recorded on work station that shall be installed in the check post/entrance

room. The system shall process the images from the camera into single view of the undercarriage and display it on the LED with date and time.

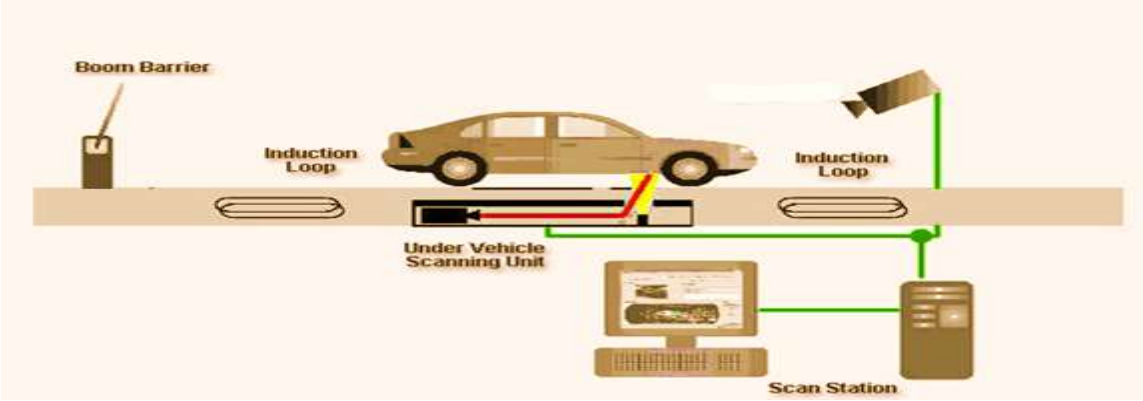
The system shall be able to handle vehicles moving at different speeds ranging from 10-70 km/hr while the captured composite image shall be automatically adjusted according to the speed of vehicle.

The cameras shall have the ability to capture the images in direct sunlight and in complete darkness. This system will support fast and easy detection of dangerous objects, for example, weapons and explosive materials etc. The system shall give a real time complete under belly image of vehicle. In case of suspected image, the operator shall be able to zoom into any area of the image to take a closer look.

In contrast to conventional vehicle underside control methods like hand-held mirrors, this system will facilitate reliable safety inspection without slowing down the flow of traffic at the entrance points.

The UVS system shall be linked with road blocker to control the movement of vehicles entering in the Sindh Forensic Science Laboratory. The up/down movement of the blocker will be automatic and will be controlled by the person operating the Vehicle Surveillance System. After clearance, the blocker shall be lowered/ detached by activating the control button or manually. Once the vehicle goes passed the road blocker, it will be elevated again to stop the next vehicle. Red & Green traffic lights will be installed along the road blocker to guide the driver when to stop and proceed respectively. At Exit point, blocker tire killers shall be installed to stop the traffic coming from the opposite direction. The whole system shall be UPS protected.

The logical diagram of Vehicle Surveillance System is shown in Figure 1.1.



3 ACTIVE & PASSIVE COMPONENT DETAIL

3.1 STATIONARY UVSS SYSTEM

Capture images of a vehicle's undercarriage while in motion, Resolution: 20 MP, Color Image, Field of View: 180º, Illumination: 480W dynamic CCD LED array, Operate in all lighting conditions (daytime, night-time, etc.), The system must be equipped with a sensor; upon detection of an oncoming vehicle it would activate the scanning unit before the vehicle is physically moving over the lens of the scanning unit, Load bearing capacity 50 Tons or higher, Anti-fogging protection, The system must automatically display the full vehicle undercarriage image on the LED, The captured image must remain on the on-screen even after the vehicle passes for continued inspection, The scanning unit must be able to operate within -35°C to +60°C, The scanning unit must be equipped with a protection case and complete guide to facilitate the correct movement and positioning of the vehicle over it, The scanning unit must be anti-water, anti-dust, anti-damp, anti-frost, anti-fog, anti-crush, UVSS must handle vehicle speed between 10-70km/hour, UVSS must check the width viewing angle: <=4 meters and Vehicle chassis height<=0.19 ft

3.2 ANPR CAMERA TO CAPTURE IMAGE OF NUMBER PLATE

2MP Access ANPR Camera with CMOS image sensor, Illuminator Number 6 or more white light illuminators, brightness adjustable, Image Resolution 1920 X 1080 (OSD black strip excluded), Illumination Distance 30 m, Capture Distance 8 m – 30 m, Detected Width 6 m – 7 m, Min. illumination 0.002 1x, Detection Speed 60 km/h

3.3 HYDRAULIC ROAD BLOCKER

Blocker width: Three (03) Meters, Blocker body: Manufactured from heavy duty high grade steel, fully hot dipped galvanized for long term corrosion protection, Front plate, powder coated Black with Yellow stripes, Road plate, chequer plate / diamond plate, 8 ~ 10 mm, Steel, non-skid, plain galvanized finish, Hinges are of robust construction specially manufactured from heavy duty high grade steel designed for high volume traffic situations and harsh environments, The blocker is designed for pit mounting, a reinforced concrete foundation is required as per manufacturer's design, Cabinet: Weatherproof housing containing PLC, hydraulic power pack c/w hand pump and mains power supply unit, Cabinet is manufactured from Zintec Steel, powder coated Yellow 75 Micron MDFT, Hoses: 10 Meter long as standard, High grade PVC coated hydraulic hose, rated to 2250 psi, Raised Height: 600 ~ 800 mm, Raise / Lower: 5 seconds approx., Power: 230v AC 50 Hz Single Phase. 16 Amps start up, 6 Amps running, Control: Push Button rise / lower, PLC can be integrated in to any new/

existing access control system, Safety: The Road Blocker's moving part should at no place be overlapped with outer frame, Temperature: -20 to +60 C

3.4 HYDRAULIC TYRE KILLERS

Weight of a tyre killer will be 1-1.5 tons (depending on tyre killer type and accessories), Typical raise/lower time is 3 seconds, In case of emergency, raise/lower time can be as low as 1.5 seconds.

3.5 SOFTWARE FOR ANPR SYSTEM

Large format horizontal display, Supports querying the images according to the date, time and plate number. Supports adjusting the saturation, contrast, balance and sharpening of the images; supports zoom-in/out of the image, magnification can up to 16 levels; supports partial magnification. Automatic Storage/Deletion. Vehicle Chassis Information history Comparison. The software automatically finds and identifies suspicious items in the vehicle chassis, and automatically selects and prompts the suspicious items through the software to assist the operator

3.6 POLES FOR ANPR CAMERA & SIGNAL LIGHTS

Pole for ANPR Camera 5 to 8 Feet long and pole for signal lights 5 feet long shall be placed near the check post at the main entrance of Sindh Forensic Science Laboratory.

3.7 SIGNAL LIGHT RED & GREEN

Signal light Red & Green shall be installed on the 5 feet pole near the check post.

4 APPLICABLE STANDARDS AND CODES

Structured Cabling System Standard ANSI/TIA/EIA 568 series
Labeling Standard TIA/EIA 606 series

5 DRAWINGS (SHOP, AS-BUILT)

The contractor shall prepare shop drawings to indicate location of Under Vehicle Surveillance System equipment, cable routes etc. keeping in view the actual site conditions and submit for approval prior to start of cable laying process. As-built drawings shall be prepared by the Contractor after the successful testing of the cabling infrastructure.

6 INSTALLATION REQUIREMENTS

Installation of all equipment shall require close coordination between the contractor and the Client personnel. Exact location of the Equipment shall be submitted for Consultant/Engineer Incharge's approval. The contractor shall

ensure that the cabling and crimping/termination of installed equipment shall be done in accordance with the industry standards and supported by the Original Equipment Manufacturer (OEM).

7 TESTING & COMMISSIONING

The contractor shall make necessary arrangement including tools, access etc. for scheduled site inspections. The reports shall be submitted to the Client after successful completion of testing/commissioning phase.

All the active equipment shall be tested & commissioned by the Contractor as per the approved test/commission plan by the Consultant/Engineer Incharge.

8 TRAINING

The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant. However, two levels of training shall be imparted; user level and administrative/advanced level.

9 DOCUMENTATION

The contractor shall provide technical documentation that includes all layouts, complete labeling scheme, workshop/ shop drawings, active equipment configuration detail, as-built drawings, etc. which are necessary for complete installation in light of the tender documents. All user manuals shall also be submitted.

10 WARRANTY & MANAGED SERVICES

The Contractor shall provide comprehensive one year on site warranty and managed services of all active equipment. During this period, it will be the responsibility of the Contractor to rectify any defects and provide services such as preventive maintenance, configuration of equipment, problem rectification within the permissible downtime and backup equipment inventory. The necessary patches, upgrades and updates as and when released by the original supplier shall also be provided during the warranty period so as to ensure that the system is functioning to provide the best performance.

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25. INTEGRATED BUILDING MANAGEMENT SYSTEM

1-01 GENERAL

The intent of this Specification to provide a guideline for an Integrated Building Management System (IBMS) encompassing Heating, Ventilation and Air Conditioning (HVAC) system, Electrical Systems including Generators and Energy Monitoring System, Fire Fighting System, Fire Alarm System, Elevators, and Potable Water System. The IBMS must be user-friendly, Windows-like software graphics user interface, having known reliability, extremely responsive and shall be designed, supplied, installed, tested and commissioned by authorized representative of the manufacturer.

The IBMS shall provide continuous monitoring and control for the following systems as per the tentative Sequence of Operation and DDC Point Summary (the Contractor shall verify these and expand if necessary) as mentioned in this document:

a. HVAC System including Plant Room equipment, AHUs, Plume Fans, etc.

b. Electrical System including Generators and Energy Monitoring System

c. Fire Fighting System including Pumps and Tanks

d. Fire Alarm System

e. Potable Water System including Pumps and Tanks

f. Elevators

The control system shall be based on the use of Direct Digital Control (DDC) supplemented by electric and electronic controls.

The IBMS shall be flexible in design, configuration and construction in both software and hardware to allow for future expansion and modification, e.g. to increase in DDC controllers, workstations, etc.

All sensors, field devices, thermostats, control valves, actuators, DDC controllers, etc shall be, preferably, from the same IBMS manufacturer. The complete system shall be installed, tested and commissioned by the authorized representative of IBMS manufacturer.

IBMS components shall be interconnected through Building LAN which shall be provided by the Contractor of ELV/IT Works. Said Contractor will configure VLAN for IBMS as per Project Requirements. Last mile UTP Cabling from LAN node to connected device shall be responsibility of IBMS Contractor.

Standalone UPS shall be provided for the IBMS Control Room components including operator workstation and display screen etc.

All power supply to DDC controllers and devices, etc shall be provided by the Contractor. The Contractor shall include all necessary electrical protection to prevent unusual voltage spikes, electromagnetic

interference and static pick up, etc from affecting any sensitive equipment.

Instruments or control devices shall not be located where they will interfere with the operation or removal of equipment, nor shall conduits, trunking or piping be run so as to interfere with the access of any equipment. All control wiring, conduit, trunkling, etc shall be properly tagged to the satisfaction of the Engineer.

1-02 SCOPE OF WORK

The Integrated Building Management System shall be used for monitoring and control of various systems installed at Sindh Forensic Science Laboratory, Karachi. These systems include the following:

1. HVAC System

i. HVAC Plant Room equipment including:

   a) Electric Centrifugal Chillers (3 nos.)
   b) Cooling Towers (3 nos.)
   c) Hot Water Generator (2 nos.)
   d) Chilled Water Pumps (3 nos.)
   e) Hot Water Pumps (3 nos.)
   f) Oil Lift Pumps (02 Nos.)
   g) Condenser Water Pumps (3 nos.)

ii. Air Handling Units for floor conditioning (8 nos.)
iii. Air Handling Units for labs (6 nos.) with DX-Condensing Units (3 nos.)
iv. Energy Recovery Ventilators (5 nos.)
v. Plume Fans with VFDs (5 nos.)
vi. Smoke Extraction Fans (2 nos.)

2. Electrical System

i. Generators
ii. Energy Monitoring System

3. Elevators

4. Fire Fighting System including Pumps and Tanks

5. Fire Alarm System

6. Potable Water System including Pumps and Tanks

The IBMS shall comprise of both protocol-level integration of independent systems as well as standalone DDC Controllers connected with systems for local monitoring and control. A local display panel such as an LCD mounted on DDC controller or a Tablet with compatible app shall be used for local information display and control. Systems, as specified in this document, shall have protocol-level integration with IBMS.

All the DDC Controllers shall have the capability to integrate through open protocols, preferably BACnet over IP, into IBMS for central monitoring and control. For integration, all the necessary data for

monitoring and control purposes shall be made available by the DDC Controller to the IBMS Control Room.

The IBMS Control Room shall house computer, necessary software, and allied networking equipment such as network switches.

The equipment which is to be directly integrated at protocol-level with IBMS such as Chillers, Hot Water Generators, etc. communication card having interface on open protocols, preferably BACnet, shall be supplied by the respective equipment suppliers.

All labour, material, equipment and software necessary to meet the functional requirement of the system as specified herein shall be included in the scope of work. Drawings are diagrammatic only and all controls, materials, etc. not shown but necessarily required to meet the functional intent shall be provided without any additional cost to the Client.

The Contractor shall discuss the control layout with the Engineer and coordinate at site with other services for exact route, location and position of control equipment and wiring.

The IBMS installation shall conform to the applicable standards of NFPA, NEC, IEC and UL and the local electrical codes. All devices designed for or used in line voltage applications shall be UL listed.

The sequence of operation will be submitted by the IBMS Contractor which will be reviewed and approved by the Consultant.

1-03 CONTROL AND MONITORING

The system shall comprise of a fully integrated Control System incorporating Direct Digital Control (DDC), consisting of the following elements:

1. Microprocessor based DDC Controllers, interfacing directly with sensors, actuators and environmental delivery systems (i.e. HVAC equipment, pumps, fans etc.)

2. Electric/electronic controls and sensors and final control elements including VFDs and actuators etc.

3. A peer communication network to allow data exchange from field devices to DDC controllers.

4. Integration of all DDC Controllers with IBMS so that central monitoring and control of HVAC System can be performed from the IBMS control room.

5. Protocol-level integration of specified systems and equipment preferably over open protocols.

1-04 COORDINATION

1. Coordinate with different services including HVAC, Electrical,

Fire Fighting, Fire Alarm, Elevators, Potable Water System, etc. for determining the location of their relevant equipment.

2. Coordinate with HVAC Contractor for installation of all field devices including sensors, switches, actuators etc. and DDC Controllers etc. for HVAC equipment.

3. Coordinate equipment from other services including Motor Control Centers, Generators, Fire Alarm Panel, Water Tanks, etc. to achieve compatibility with equipment that interfaces with those systems.

4. Coordinate supply of conditioned electrical circuits for control units.

1-05 CONTROLLER SPECIFICATIONS

1-05.1 GENERAL

The DDC Controller shall be of Advanced Application Controller (AAC) class for HVAC equipment. These controllers shall be built up of modular microprocessor based DDC controls units. The DDC system must be self-sufficient and ensure the automatic operation of the entire IBMS. It should be taken into account that the operation of the electrical, mechanical and other services must be optimised to ensure energy efficient operation.

The DDC units must be programmable, stand-alone, ensure complete monitoring and control of the building services integrated with the Control System, and have a fast system response. The units must be fitted with a powerful processor with high processing speed, a suitably sized memory capacity and a modular graphic programming language for the project specific application programmes.

The programmable language must be self-explanatory and self-documenting. The programming language must further contain all function elements which allow the versatile connection of control and interlock functions, the application of control algorithms such as P, PI, PID, the simple and precise setting of parameters, alarms and limit values.

For the communication between the DDC modules, a bus-system must be used which provides a peer to peer communication with fast and secure data transmission. The communication between the individual DDC units must stay fully operational even when individual DDC units fail.

Provide an adequate number of control units to achieve monitoring and control of all data points specified and necessary to satisfy the sequence of operation for all systems as specified in drawings and specifications. Controllers shall meet the following requirements.

1. Controllers shall be suitable for the anticipated ambient conditions.

2. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures.

3. Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.

4. Immunity to power: Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.

5. All DDC controllers must have 10% spare input/output points (AI, DI, DO & AO).

The Controller shall have sufficient Input/Output points to meet the Project requirements. Stand-alone mode control functions operate regardless of network status. Functions include the following:

i. Peer to peer primary network level communications with automatic communications loss detection to maintain normal control functionality regardless of available network communications.

ii. Discrete/digital, analog, and pulse input/output.

iii. Monitoring, controlling, or addressing data points.

iv. Appropriate BACnet objects for specific unitary applications.

v. Incorporate internal customizable safeties and limits to prevent third party BACnet tools from providing improper and unrealistic inputs to the Controller.

Communication: Controller shall communicate with the central system and other Control devices through open protocol, BACnet over IP. An Ethernet 10/100 Mbps port shall be provided for LAN communication.

Controller shall have capability to monitor/control the input/output points; process information; and expressions for customized HVAC control including mathematical equations, Boolean logic, PID control loops with anti-windup, sequencers, timers, interlocks, thermostats, counters, interlocks, compare, limit, and alarms.

A handheld operator panel/tablet etc. shall be provided for local monitoring and parameter setting of DDC Controllers.

1-05.2 FUNCTIONS

Standard basic functions resided with each programmable DDC controller shall include the following:

Basic functions (software modules) which can be combined by means

of application programmes to form any control and interlock strategy required.

Control Functions shall include but not limited to the followings:

- universal setpoint calculation
- modulating control functions, P, PI, PID
- additional modulating sequence
- analogue or digital output steps with selection logic, manual override, interlock, time functions, limit control, D/A conversion
- universal heating curve (with adaptable algorithm)
- compensated heating control
-

Logic Functions shall include but not limited to the followings:

- Slew rate limiter
- programmable output block
- analogue or digital interlock block, with selected logic
- logic functions (AND, OR, NOT, EXOR....)
- channel selector (for individual switching of system parts)
- heating logic
- demand dependent switch
- time clock (8 channels, 24 hours, 7 days, yearly switch functions)
- run time totaliser
- ring counter
- data transmitter
- alarm handler
- timer

Energy Management Functions shall include but not limited to the followings:

- self-adaptive optimiser
- occupancy control
- adjustable deadbands
- duty cycling
- air quality control
- time control
- demand related reset functions
- enthalpy control etc
- air purging

1-06 SOFTWARE

1-06.1 Software - General Requirements

The system shall be defined with five levels of software which shall include operating systems and programs which are present in volatile or non-volatile memory i.e. firmware.

Operating system – Windows 10 Professional or similar modern OS supplied with computer equipment (tenderer to state operating system on which tender is based)

IBMS program - Supplied by the IBMS manufacturer
Configuration - Created by the installer
Graphic pages - Created by the installer
Parameter - Commissioned by the installer and modified by the client

Obtain, on behalf of the end users, all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software suppliers for support and appropriate updating.

The Contractor shall supply a firewall software to fully protect the computer network and computer system. The firewall shall be used to provide protection but not limited to; from all remote connections, between each LAN system; between BMS and Third Party System using the network. The firewall shall not rely on simple bit masking filtering of packets. The provision of firewall shall allow only authorised personnel to use any PC within the networked environment to perform management functions.

1-06.2 Software Warranties

Warrant the BMS system to be error free within the system warranty. It shall not be possible to invalidate this warranty. Inform the client of any defects which may become apparent through the use of this software in other systems.

Warrant the configuration to be error-free as commissioned. It shall not be possible to invalidate this warranty through modification of parameters.

Warrant the graphic pages to be error free as commissioned. It shall not be possible to invalidate this warranty through addition of further pages or modification of parameters.

1-06.3 Software Development

Prior to commencing the development of project specific software, the Contractor shall confirm the following information is provided with the tender:

1. operating system, revision and issue number,

2. other packaged software to be provided, revision and issue number,

3. availability and cost of any further appropriate packaged software not specifically specified,

4. functional description of any software needed to be written for "The Works", procedure for its preparation and development period. Provide summary of previous experience of writing similar software,

5. details of software support service available to client, where future software would be written and how it is charged.

Demonstrate the operation of all software for conformity with the specification prior to installation.

Procedures for modifying the configuration, graphics pages and parameters shall allow alterations and additions to be made systematically without the need to shut down the BMS or any Engineering Systems.

All software shall support, without modification, the future addition or removal of outstations or points up to the practical limit of the installed software.

1-06.4 Software Support

Provide as part of the Operating and Maintenance Documentation two back-up copies of all software items, as commissioned, to reload the system to its commissioned state in the event of subsequent software failure.

During the warranty period, make a back-up copy of all software items prior to making any software changes, to reload the software in its previous form in the event of a subsequent software failure. Lodge this software with the client.

When existing software is replaced, retain a copy of the superseded software for a minimum of one year. Lodge this and any further updates with the client.

The IBMS software shall support the following system management and operation features:

1. User Definable Classes:

Passwords shall be allocated to one or more user-definable operator classes. Access to data points and function blocks shall be partitioned according to discipline e.g. HVAC, electrical, etc. Up to 12 operator

classes shall be supported.

2. Pull Down Menus:

Pull down menus shall show the possible options under the selected main menu item which shall be available to the operator according to the respective password level at which he is logs in at.

3. Software Help:

A Help module shall be integrated in the IBMS software which shall provide assistance through display of instructions regarding any chosen menu item. The displayed text shall be "context-sensitive", i.e. relevant to the function or menu item which is currently selected, and describes the consequences of involving the associated command.

4. Reporting Package:

The reporting package shall provide the actual status of data points or functions which the user can specify for a selected system controller from the range of options listed below. All reports shall be accessible from the report menu.

Report by Name

Shall allow information to be grouped by name (e.g.“ON/OFF status” of all Split Air Conditioners).

Report by Type

Shall allow information to be grouped by block (e.g. all digital output blocks).

Report by Address

Shall allow information to be grouped by data point location within the system configuration (i.e. module physical address).

Report by Status

Shall list all points which are in a specified status (e.g. in alarm, under manual control etc).

Report by Class of Alarm

Shall allow information to be grouped by class of alarm.

Report by Value

Shall group information by value (e.g. all fans that are ON).

In each case above, the user may use the specified entry/variable to

generically group data points or functions into a single report. More specific report options shall include Control Block Report, Alarm Log Report, History Report and Custom Report as herein below specified.

Control Block Report

Shall display block parameters and dynamic values for a specified source block and the subsequent blocks in the program chain. The user can specify the number of program branching levels which are to be listed.

Alarm Log Report

Shall display contents of the alarm log file resident on the PC hard disk.

History Report (Trend Logging)

Shall display the accumulated values and statuses in a specified history block, in chart or graphical format.

Custom Report

Shall display actual values of pre-selected data points and functions together with user texts, which are completely configured and freely formatted at the generation stage as templates.

Unlike the other reports described above, this report can also be generated automatically on an event-driven basis for output to hard-disk, printer or screen.

The data points and functions which are configured for this type of report do not need to be resident in the same system controller.

1-06.5 Software Monitoring & Control Routines

General

The software routines necessary to process all types of input shall be resident in the outstation. Unless described within the individual control loops, software routines shall satisfy the requirements of this section.

Binary Inputs

Binary input routines shall be configurable such that one or more events may be enabled in direct response to any defined logical relationship between the status of a number of physical or soft points.

Analogue Inputs

Analogue input routines shall permit

- assignment of limiting values to each analogue point with each limit being associated with a configured response

-setting of both maximum control deviations and absolute limit for each point

-configuration of the system so that, modifications made to any limit at the outstation are automatically reported to the central operator facility

-definition of a relationship between an analogue point threshold value and a digital point status

Pulsed Inputs

Store pulsed input signals as cumulative total. Permit operator to reset counter.

Compare the number of pulses with preset limits on the Basis of total number of pulses per unit time; or time required for a total number of pulses; or as indicated.

Where pulsed inputs are used to monitor fluctuating pulse rate permit:

-assignment of limiting values to each point with each limit being associated with a configured response

-setting of both maximum control deviations and absolute for each point

-configuration of the system so that, modifications made to any limit at the outstation are automatically reported to the central operator facility

-definition of a relationship between a pulsed input point threshold value and a digital point status

When data for pulsed inputs is recorded or archived, record shall include both pulse count and logging interval for cumulative counts.

Positive Feedback

Provide routines to confirm that items connected with the IBMS system are functioning correctly by monitoring physically separate but functionally related sensors, transducers or soft points.

Raise an alarm, if after a preset time following switch on, the expected response has not been established. Permit operation of any standby system equipment. Operator to adjust preset time.

Ensure that the outstation can accommodate measured feedback of the actuator and give a percentage open reading, where required.

Run Time Totalisation

Provide run time totalisation routines to record cumulative run time for each item of system equipment selected. Provide operator with facility to select any system equipment.

Provide operator with facility to set a different maximum run time for each item of system equipment selected.

Signal alarm when maximum run time is reached.

Permit central facility operator to interrogate outstations for a point by point summary of run time totals and run time limits.

Permit user to set initial values of hours run other than zero.

Trend Logs

Provide trend logging routines to prepare logs at each outstation for any real or soft point on the system.

Logs to include

- measured values
- status reports

Provide operator option to specify:

- desired logging duration
- start and/or stop time of trend period
- logging frequency

Software Control Routines - General

Performance of software routines controlling the system operations shall:

- allocated data obtained from field devices to appropriate control software routines and algorithms as defined by the operator

- provide routine to allow pulsing of control signal to the actuators as a means of controlling rate of movement of actuator

- provide facility to drive actuators to open or closed positions at end of relevant system operating periods

Control Modes

Software routines necessary for direct digit control (DDC) to be resident in outstation.

Provide DDC of selected items connected to the IBMS through algorithms giving proportional plus integral plus derivative (P+I+D) control.

Ensure it is possible to select independently for each device

- proportional control (P)
- proportional plus integral control (P+I)
- proportional plus integral plus derivative control (P+I+D)

Whatever control action selected ensure proportional band, integral action time and derivative action time are adjustable by the operator to suit the process lags of the controlled system and to ensure adequate system response for stability.

Time Control

Control equipment connected to the IBMS by switching on or off to preset time schedules. Provision of a minimum of 3 separate operating periods for each 24 hour period foreach item of the system shall be present in the software.

Pre-programmed start/stop schedules for air-conditioning, ventilation and electrical system connected to an outstation to be available at that outstation at all times. Schedules are to include variations to suit

- weekends
- holidays

as pre-programmed by the operator.

Permit superimposition onto a standard time schedule of:

- optimum start/stop control day omit
- fixed extension and contractions

Control to automatically revert to standard time profile on subsequent days.

Program calendar to accommodate leap years.

Start/Stop Control

Start and stop HVAC system as scheduled. Before restarting HVAC system after any failure, ensure the system items revert to the specified off condition, and then restart under the specified sequences, including any delay periods.

Operate standby system automatically on failure of duty system where indicated. Report to central operator facility HVAC system item failures.

Unless otherwise specified, alternate lead HVAC system where duty and standby items of equipment are installed on time scheduled Basis.

Provide delayed HVAC system start facilities to minimize power surges. Permit HVAC system to start sequentially by adjustment of delay period for each HVAC system item.

Air-conditioning System Protection During Shut-Down

Provide air-conditioning system protection routines with operator authority to select and automatically run items of air-conditioning system

for short periods during out of season shut-down. Run periods to be operator adjustable.

Air-conditioning system protection routine to be overridden by the normal sequence of air-conditioning system operation.

Packaged Pumping Equipment Management

Supervise the safety and operation of controls provided with the packaged pumping units.

Provide the following central controls:

- On/off command signal to the pump set controller
- Signalling of faults and alarms

Monitoring the following minimum performance parameters:

- electrical load
- pressure of water
- hours run

and as indicated in the points schedule.

1-06.6 Graphical Operation

Generation

The graphics editor shall provide the following facilities which enable customised graphics to be created by the user for the operational purposes:

- Standard HVAC and electrical symbol library to assist rapid graphic generation
- "Cut and paste" feature for relocating a generated graphic portion within the same graphic or transferring to another graphic.

Handling Facilities

The following facilities shall be available to the user to simplify operation with the graphic package:

"Graphical doorways" which enable the operator to rapidly (typically in 0.2 seconds) step hierarchically from one graphic to another by clicking the mouse.

This shall allow the building or site to be broken down into several graphics following a tree method; the user is thus guided in his movements between graphics along branches as defined the graphical doorways.

Password levels assigned to each of the doorways shall be implemented

to hide any unauthorised or non-relevant pathways from the operators view.

Oversized graphics shall be supported to provide the user with an uncluttered view of detailed graphics which are larger than the physical screen size as given below:

- Max. width of graphic : 30 x screen width
- Max. height of graphic: 30 x screen height

Pan and scroll movements controlled by the mouse enable the user to view any portion of the oversized graphic. Such movements shall be smooth to the eye without any visible "jitter" or jumping effect.

De-cluttering shall cause non-relevant information to be automatically hidden from the operator when viewing a graphic, according to which operator class his password is allocated to. This function shall be able to be invoked manually whilst being on-line in a given graphic.

Icons shall be provided to simplify operation and allow special functions to be activated using the mouse only, thereby further reducing keyboard strokes.

Jumps tags shall enable the user to "jump" to a predefined display area by activating a corresponding jump tag icon.

Pop-up windows shall be employed to provide additional information on the screen about the selected item (point name, address and text description) as well as for displaying the manual command options. In both cases the appropriate window "pop-up", depending on which mouse button is clicked, otherwise these displays shall be normally suppressed.

Dynamic Operation

The following dynamic interactions between the operator and the field shall be given :

Dynamic colour display of the status and values of defined physical and calculated datapoints within designated fields located in the graphics. Digital statuses of datapoints can additionally be displayed by the colour, shape and mode (whether flashing or not) of their associated graphic symbols .

Analogue and totalised values can additionally be displayed graphically using thermometer symbols such that the length of the associated thermometer column is varied dynamically in accordance with the analogue input.

Manual control menus shall allow the operator to turn points on and off, start and stop points, adjust set points, release points to automatic control etc. This menu shall be displayed in "pop-in window" which appear when the selected item is clicked with the mouse.

Trend icons shall invoke trend displays directly from the graphic of the

associated system equipment.

Phone icons shall be able to invoke dialling messages to modems to establish communications links with remote system controllers.

1-06.7 Alarm Management

General

Alarm monitoring shall be performed at the system controller level based on alarm blocks which monitor the associated inputs. These shall be defined and attached to the selected physical and calculated points to be monitored, at the engineering stage.

Alarms which are detected shall be subsequently reported to a corresponding device as defined in the alarm device block, where they shall be presented to the user for subsequent action to be taken.

Monitoring

Alarms can be monitored for any physical or calculated point in the system based on:

- digital change of state
- analogue high and low limits (sliding or non-sliding)
- command/feedback mismatch
- counter totalisation limit
- conditional case

Reporting

When activated, alarm device blocks shall direct the associated user defined messages to the IBMS computer in the IBMS room for display and the system may be configured to generate a report from the printer connected directly to it.

Alarm device assignments shall be collective for all alarms belonging to the same alarm class as per “Alarm Categories" hereunder.

Suppression

Alarm suppression shall be programmable such that events (e.g. system shutdown) can be used to inhibit or enable the reporting of alarms. Any necessary time delays can also be taken into consideration at the programming stage.

Verification delays can be defined for command/feedback points to suppress invalid alarms where the feedback does not normally respond immediately (e.g. from flow switches).

Alarm Categories

Alarms shall be categorised into different classes eg abnormal, maintenance, critical etc, for partitioning disciplines and grouping alarms together for routing purposes.

Presentation

Alarm messages directed automatically to printers connected to the corresponding system controller or a configured management station can consist up to 40 characters.

Any present unacknowledged alarms shall be identified by whether the screen boundary has changed colour.

Different colours can be defined to partition alarms for presentation purposes, including whether this should be accompanied by an audible buzzer or not.

If a graphic displayed on the screen contains a point which is in alarm condition, the symbol associated with that point shall be seen to be flashing in the designated colour.

Action/Acknowledgement

Alarms can be acknowledged individually through the following:

i. Menu command

ii. A pop-up window shall be activated by clicking on the flashing symbol indicating the point in alarm.

Alternatively jump tags can be implemented to direct the user to graphics which contain pre-configured alarm tables. In this case the user obtains a status overview of all possible alarms in a given system or building, from which they can subsequently acknowledged individually.

Further measures to be taken by the user in the event of incoming alarms can be configured in help screens which are accessed via slide icons selectable from within the above alarm tables.

In both cases above, the dynamic alarm display shall only reset when all outstanding alarms have been acknowledged.

1-06.8 Trend/History Package

All real-time data relevant for trend and historical purposes shall be in the first instance gathered by the system controllers.

The resulting data logs maintained by the system controllers can be requested by the operator at a management station connected to the system controller network for immediate presentation and/or archiving to disk.

Data Logging

The system controller can be configured to gather data from any physical or calculated point in the system.

Storage Capacity

A system controller shall have a fixed total amount of memory space which can store time-and-date stamped samples.

How this memory is shared between the data points which are to be sampled can be configured by the user. Hence it is possible to configure a system controller to maintain smaller records of numerous data points, or alternatively larger records of fewer data points.

1-07 CONTROL PANELS

Local Control Panels: Unitized NEMA 1 cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.

1. Fabricate panels, furniture-quality steel, or extruded-aluminum enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish.

2. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.

3. Door-Mounted Equipment: Flush-mount (on hinged door) manual switches, including damper-positioning switches, changeover switches, thermometers, and gauges.

4. Provide ON/OFF power switch with over-current protection for control power sources to each local panel.

1-08 FIELD DEVICES - General

Provide where indicated on the drawings or as specified, the microprocessor, electronic and/or electric control system components and sensing devices as required. The field devices shall be interfaced directly with the Control System to provide a totally integrated control system.

Input/output sensors and devices shall be closely matched to the requirements 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 of precise and responsive control.

1-08.1 Temperature Instruments

Resistance temperature detectors shall be Platinum, thermistor or balco.

a) Temperature Sensor Immersion Type: The Sensors shall be resistance thermometer detector type with a range of minus 35 degree C to plus 260 degree C with an accuracy of plus or minus 0.1% at the reference temperature. It shall be provided with a separable copper monel or stainless steel well.

b) Temperature Sensors Insertion Type: The sensor shall be rigid stem or averaging type as specified in the sequence of operation. It shall have nickel sensing element in a copper tube or with integral 4-20 mA converter with a temperature surging accuracy of $\pm$0.12% at 0°C or better. Operating temperature range shall be 0°C to + 60°C with an accuracy of $\pm$0.2°C.

c) Temperature Sensors Space Type: Sensor shall be with remote set point adjustment capability and temperature indication. It shall be provided with institutional type locking covers. The operating range shall be 0°C to 60°C with an accuracy of ± 0.2°C.

d) Combined humidity and temperature sensor: Space type sensor shall be with remote set point adjustment capability and with digital display. It shall be provided with institutional type locking cover. The operating range for temperature shall be 0°C to 60 °C with an accuracy of $\pm$ 0.2 °C. Relative humidity sensor shall use non-saturating sensing elements. Operating range for humidity sensor shall be 10 to 90% with an accuracy of $\pm$2% of full scale.

e) Temperature Switches: Temperature switches shall have a repetition accuracy of plus or minus 1% of their operating range. Switch actuation shall be adjustable over the operating range. The switch shall have snapaction form-C contacts rated for the application. Switch contacts shall be wiping contacts of platinum alloy, silver alloy or gold plated and shall have an adjustable differential setting. The operating temperature range shall be 0 degree C to +60 degree C. The switches shall have provision of connecting remote set point adjustment arrangement.

f) Temperature sensor for outside air: The sensor shall be weather proof type suitable for mounting in open and shall be provided with sun shield and splash proof housing. The operating range shall be -40°C to +130°C with an accuracy of ±0.2°C.

1-08.2 Humidity Instruments

Humidity Sensors: Relative humidity Sensors shall use non- saturating Sensing elements. Sensors shall have a range of 10 to 90% with an accuracy of plus or minus 2% of full scale.

1-08.3 Pressure Instruments

a) Pressure Sensors: Pressure sensors shall withstand up to 150% of operating pressure. Pressure sensor accuracy shall be plus or minus 1 % of full scale. Pressure sensors shall be either capsules, diaphragm, bellows, bourdon tube or solid state.

b) Pressure Switches: Pressure switches/differential pressure switches shall have a repetitive accuracy of plus or minus 1% of their operating range and shall withstand up to 150% of operating pressure. Sensors shall be diaphragm or bourden tube. Switch operation shall be adjustable over the operating pressure range. The switch shall have a snap action form - 'C' contact rated for the application. Switch contacts shall be wiping contacts of Platinium Alloy, Silver Alloy, or gold plated and shall have an adjustable differential setting.

1-08.4 Flow Instruments

1. Water Flow Meter

Water Flow meter shall be electromagnetic type. They shall comprise pipeline mounted sensors of diameters selected by the Contractor to suit the application. The sensor shall be of the insertion type and suitable for the system temperature and pressure. It shall consist of a flow sensor which forms a section of the pipe and an electronic signal converter. The electromagnetic flow meter shall use DC excitation on the sensor’s field coils.

The flow sensor shall be sized to meet the manufacturer’s recommendations for the range of flow rates to be measured. The flow meter including sensors shall have an accuracy of ±0.25%or better of actual flow and repeatability of 0.1%.

The sensor shall have a hard rubber lining and with stainless steel AISI 316 electrodes. The sensor shall have an enclosure grade of IP-67 and shall withstand medium temperature of 80° maximum and 0° C minimum.

Measuring head shall be for flanged installation in accordance with DIN 2501. Depending on the size of the measuring head to be installed the nominal pressure rating of the said flanges shall be clearly specified during submission. Material of construction of the flanges to be in carbon steel 37.2.

The magnetic flow meter shall be modular design which allows the exchange of electronics modules for expansion at any time. Eg RS 485 and HART interfaces.

The electrical output from the transmitter shall be standard 4-20mA output proportional to the water flow rate. The resultant signal generated shall be amplified to produce an output acceptable by the DDC/CONTROL SYSTEM. The electrical input and output from the flow meter must be protected by lighting/surge arrestors equal to DEHN. The Contractor shall propose and submit to the Superintending Officer for approval.

2. Flow Meter Converter/ Amplifier

The flow meter converter/ amplifier shall be completely microprocessor-controlled and to be mounted remotely up to 200m form sensor. Converter housing shall be IP-67 protected and coated with at least 2 component epoxy resin.

Local display shall be 2 lines illuminated LCD. Programming to be through touch control infrared optical sensor, without opening any cover of the converter. LCD to display at least:

- Flow rate as % or unit (SI or Imperial)
- Totalizing flow value (unit independent of flow rate unit setting)
- Other programming parameters like creep suppression, time constant, etc
- Access code for security

Power supply voltage shall be 85-260 V AC and not affected by power fluctuations. All electronic broads in the converter must be freely interchangeable for different sizes of the measuring sensors heads thereby minimizing the need for stocking of spares. The converter shall have data storage as power failure for all system data without needing any batteries.

All flow meters must be wet-calibrated on precision calibrating rigs at the Works and must not require adjustment thereafter. Calibration certificate shall be supplied by manufacturer with the flow meter.

Two hand-held local operator terminals shall be provided to enable maintenance technicians to perform dry test checks on microprocessor and electronic circuitries integrity of flow meters and flow converters.

3. Flow Switch

Flow switches shall have a repetitive accuracy of plus or minus 1% of its operating range. Switch actuation shall be adjustable over the operating flow range. The switch shall have a snap action form - Contact rated for application. Switch contacts shall be wiping type of platinum alloy, silver alloy or gold plated and shall have an adjustable differential setting. For chilled water applications, provide vapor proof type.

1-08.5 Variable Frequency Drive (VFD)

The VFD shall be enclosed in a UL/NEMA Type enclosure,completely assembled and tested by the manufacturer. The VFD shall provide full rated output from a line of ±10% of nominal voltage. The VFD shall continue to operate without faulting from a line of +30% to -35% of nominal voltage.

VFDs shall be capable of continuous full load operation under the following environmental operating conditions:

a. -5 to 45 °C ambient temperature. Operation to 50 °C shall be allowed with a 10%reduction from VFD full load current.
b. Humidity less than 95%, non-condensing.

All circuit boards shall be coated to protect against corrosion.All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating.

The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate “bumpless transfer” of speed reference when switching between “Hand” and “Auto” modes.

VFD programming shall be held in non-volatile memory and shall not be dependent on battery power. The VFD’s shall utilize pre-programmed application macros specifically designed to facilitate start-up.

The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start).

The VFD shall have the ability to automatically restart after over-current, over-voltage,under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.

The overload rating of the drive shall be 110% of its normal duty current rating for 1minute every 10 minutes, 130% overload for 2 seconds every minute.
The input current rating of the VFD shall not be greater than the output current rating. Input and output current ratings must be shown on the VFD nameplate.

The VFD shall have programmable “Sleep” and “Wake up” functions to allow the drive to be started and stopped from the level of a process feedback signal.

All VFDs to have the following adjustments:

1. Two (2) programmable analog inputs shall accept current or voltage signals.

2. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage and other data.

3. Two (2) programmable digital inputs for maximum flexibility in interfacing with external devices. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC.

4. One (1) programmable digital output

The voltage/frequency ratio shall be suitable for speed control of fans. It should not be possible to set a constant voltage/frequency ratio to prevent damage to connected equipment and to optimize energy consumption. The converter shall regulate the output to adapt it continuously to the current flow so as to minimize energy consumption.

1-08.6 Electrical Transducers

Transducers shall be of the case mounted type having the following specifications:

- 0.2 Class Index accuracy with 0.2% of reading accuracy for the Watt and VAR transducers.
- 3 times continuous overload capability at 25°C.
- 4 kV isolation between all inputs and outputs for 1 minute.

All transducers shall be of either DIN rail mounting and/or surface mounting. Transducer housing shall be of two part construction with the cover being made of flame retardant glass filled modified PPO to UL94V1 with a comparative tracking index of 200 minimum to IEC-132.25. The case material shall be polycarbonate, flame retardant to UL94V0.

1. Voltage Transducer

   The accuracy of the transducer shall be ±0.2% of full scale output and shall be capable of converting the outputs of potential transformers to industry compatible form acceptable as DDC/Control System input.

2. Current Transducer

   The current transducer shall have an accuracy of ±0.2% of full scale output and shall be capable of converting 0-5A output of current transformers to industry compatible form acceptable as DDC/Control System input.

3. Frequency Transducer

   Frequency transducer shall be capable of converting potential transformer output into an industry compatible form which is acceptable as DDC/Control System input.

4. Power Factor Transducer

   Power factor transducer shall be capable of converting potential and current transformer output signals into an industry compatible form which is acceptable as DDC/Control System input.

5. KW Transducer

   Power transducer shall accept input from potential and current

transformers, and shall produce an industry compatible output to represent power consumption.

Power transducer shall be suitable for 3 phase 4 wire unbalanced circuits.

6. KWH Transducer

KWH transducer shall consist of Kw transducer and a mA pulse converter for the monitoring of the electrical consumption with the output impulse characteristic acceptable by the DDC/Control System.

1-08.7 Static-Pressure Transmitter

Non-directional sensor with suitable range for expected input, and temperature compensated.

1. Accuracy: +/- 1 percent of full scale with repeatability of 0.5 percent.
2. Output: 4 to 20 mA, 0-5 vDC, 0-10 vDC.
3. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system: proportional output 4 to 20 mA.

1-08.8 Equipment Operation Sensors

1. Status Inputs for Fans: Differential-pressure switch with adjustable range of 20 to 200 Pa.

2. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 50 to 600 KPa.

1-08.9 Water-Flow Switches

Pressure-flow switches of bellows actuated mercury or snap-acting type, with appropriate scale range and differential adjustment, with stainless steel or bronze paddle.

1-08.10 Actuators

1. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action under all environmental conditions (temperature, low power voltage fluctuations, tight seal damper design, maximum air and water flow forces).

    a. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
    b. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2": Size for running torque of 150 in. x lbf and breakaway

torque of 300 in. x lbf.

c. Spring-Return Motors for Valves Larger Than NPS 2-1/2": Size for running and breakaway torque of 150 in. x lbf.
d. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
e. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

2. Electronic Damper and Valve Actuators: Direct-coupled type non hydraulic designed for minimum 100,000 full-stroke cycles at rated torque. The actuator shall have rating of not less than twice the thrust needed for actual operation of the damper or valve

a. Coupling: V-bolt and V-shaped, toothed cradle.
b. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
c. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.
d. Actuators shall have the ability to be tandem mounted.
e. All spring-return actuators shall have a manual override. Complete manual override shall take no more than 10 turns.
f. Power Requirements (Two-Position Spring Return): 24V ac or dc, Maximum 10VA.
g. Power Requirements (Modulating): Maximum 15 VA at 24V ac.
h. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
i. Temperature Rating: -30°C to 60ºC.
j. Run Time: 200 seconds open, 40 seconds closed.
k. All actuators shall have a 5 year warranty.

l. Valves:

i) Size for torque required for valve close-off at maximum pump differential pressure (regardless of water loop system pressures).
ii) Valve and Actuators shall come from the factory fully assembled.
iii) Spring Return Manual Override shall come with a 10 Degree Valve Preload to assure tight close off.

m. Dampers:

i) Size for running torque calculated as follows:

- Parallel-Blade Damper with Edge Seals: 7 inch-pounds/sq. ft. of damper.
- Opposed-Blade Damper with Edge Seals: 5 inch-pounds/sq. ft. of damper.
- Parallel-Blade Damper without Edge Seals: 4 inch-pounds/sq. ft. damper.

- Opposed-Blade Damper without Edge Seals: 3 inch-pounds/sq. ft. of damper.
- Dampers with 2 to 3 Inches wg. of Pressure Drop or Face Velocities of 1000 to 2500 FPM Multiply the minimum full-stroke cycles above by 1.5.
- Dampers with 3 to 4 Inches wg. of Pressure Drop or Face Velocities of 2500 to 3000 FPM Multiply the minimum full-stroke cycles above by 2.0.

ii) Spring Return Manual Override actuators shall a factory set 5 Degree Damper Preload.

1-09 CONTROL VALVES

1. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

2. Globe Valves NPS 2” and Smaller: Bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure. Valves shall have allowable media temperature of -7°C to 138°C to assure that the valve packing will have a long life (valves will narrower allowable media temperatures have no reserve packing capability for long term watertight seal).

3. Globe Valves NPS 2-1/2” and Larger: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.

4. Hydronic system globe valves shall have the following characteristics:

   a. Rating: Class 125 for service at 862 kPa and 121°C operating conditions.

   b. Internal Construction: Replaceable plugs and seats of stainless steel or brass.

      i) Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.

      ii) Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom of guided plugs.

   c. Sizing: 21 kPa maximum pressure drop at design flow rate.

   d. Flow Characteristics: Two-way valves shall have equal

percentage characteristics; three-way valves shall have linear characteristics. Operators shall close valves against pump shutoff head.

5. Steam system globe valves shall have the following characteristics:

   a. Rating: Class 125 for service at 862 kPa and 121°C operating conditions.

   b. Internal Construction: Replaceable plugs and seats of stainless steel.

      i) Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.

      ii) Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom of guided plugs.

   c. Sizing:

      i) 69 kPainlet pressure and 34 kPa pressure drop.

      ii) Pressure drop across steam valve at a maximum flow of 80 percent of inlet pressure for low-pressure systems and 42 percent for high-pressure systems.

   d. Flow Characteristics: Modified linear characteristics.

6. Control Ball Valves 3 inches and smaller (2 inches for 3-way valves): Forged brass body (CuZn39Pb2), chrome plated brass ball and blowout proof stem and EPDM o-rings with minimum 600 psi rating. Valve shall contain glass filled ball insert capable of providing equal percentage flow. Valves shall have allowable media temperature of
   -7°C to 121°C.

   a. Rating: Minimum 100 psi close off on 2 way valves and 70 psi on 3 way valves.
   b. Medium: Valves shall be used with hot water or cold water with up to 50% glycol.
   c. Sizing:
      i) Minimum 100 psi close off on 2 way valves and 70 psi on three way valves.
      ii) Maximum differential shall be 35 psi to ensure quiet operation.
   d. Flow Characteristics: 2 way vales shall have equal percentage characteristics. 3 way valves shall have an equal percentage characteristic through the control port and a linear characteristic through the bypass port.

7. Butterfly Valves: 1379 kPa maximum pressure differential,

ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.

a. Body Style: Wafer, Lug, or Groove
b. Disc Type: Nickel-plated ductile iron, Aluminum bronze, Elastomer-coated ductile iron, Epoxy-coated ductile iron.
c. Sizing: 7 kPa maximum pressure drop at design flow rate.

8. Terminal Unit Control Valves: 360 psi forged yellow brass body, nickel plated brass ball, with optimizer insert for modulating applications, blow-out resistant stem, two or three-port as indicated, and threaded ends for chilled or hot water, up to 50% glycol solutions. Actuators shall be as noted above with 5 year warranty. Spring return is required for all Unit Ventilator heating valves and other terminal equipment that has an outside air source. All non-spring return valves must have manual override ability built in to the actuator.

a. Rating: ANSI class IV, maximum static pressure of 1724 kPa minimum fluid temperature of -7ºC and maximum of 121ºC operating conditions.

b. Sizing: 28 kPa maximum pressure drop at design flow rate, to close against pump shutoff head.

c. Flow Characteristics: Two-way and three-valves shall have equal percentage characteristics.

d. All FCU valves shall be 0-10vdc modulating control with feedback, floating /PWM / Thermic / Hydraulic / On-Off valves shall not be accepted and will be rejected.

1-10 CONTROL CABLE

Cable for Control Wiring shall be UTP category-5 or better.

Adequately protect all cables from environment through which they pass through to avoid the possibility of mechanical damage or electromagnetic interference.

Install cabling and conduits associated with sensors so as to prevent spurious transfer of moisture, heat etc. from external sources to sensing devices.

All cables shall have identification sleeves at their terminations which combine the requirement of local electrical codes with those for specific circuit identification. Ensure identification is consistent with all relevant wiring/control diagrams.

1-11 SEQUENCE OF OPERATION

Tentative sequence of operation is provided below. It will be finalized

after review and approval of Technical Submittal of the IBMS by the Consultant before application.

1-11.1 Air Handling Units (for floor conditioning)

AHU supply fan shall be energized by DDC controller either by operator command or as per programmed schedule. The ON/OFF status and alarm condition of AHU shall be monitored/recorded by the IBMS.

A differential pressure switch (DPS) across AHU supply air fan shall monitor the discharge pressure. In case, no pressure differential is recorded by DPS when the supply fan is switched 'On', an alarm shall be generated and DDC controller shall shut down the AHU. The supply air fan failure alarm shall be promptly displayed on the screen of the monitoring computer, installed in the HVAC Control Room. The software application shall also show AHU status as 'OFF' due to supply air fan failure.

The AHU has four-pipe system i.e. supply and return of chilled water and hot water to control temperature and humidity in the conditioned area. During normal operation of the AHU, the DDC Controller shall monitor the temperatures of supply and return chilled and hot water. Accordingly, the chilled/hot water 3-way control valves mounted on chilled and hot water lines shall be modulated as per the programmed logic to maintain required temperature-humidity setting of the conditioned space.

Differential pressure switches (DPS) across AHU filters (pre-filter and bag-filter) shall monitor the air pressure. In case, a pre-defined pressure differential is recorded by DPS, an alarm shall be generated to indicate dirty/clogged filter condition and the alarm shall be promptly displayed on the screen of the monitoring computer.

The DDC Controller shall compare the relative humidity of return air, recorded by return air duct humidity sensor, with the set value of the desired humidity. The chilled/hot water valves in conjunction with humidifier installed in the AHU will be modulated to control humidity of air conditioned space. The humidifier shall be switched ON/OFF while chilled/hot water valves shall be modulated. Duct type humidity sensors shall also be installed to monitor/record supply air humidity for diagnostic purposes.

A photoelectric type smoke detector, installed in return air duct, shall monitor the condition of air. In case of smoke detection, an alarm shall be generated and DDC controller shall shut down the AHU and its control valves. The fire alarm shall be promptly displayed on the screen of the monitoring computer. The BMS software application shall also show AHU status as 'OFF' due to fire alarm.

A CO_2 sensor, installed in return air duct, shall monitor the quality of air. In case of contaminated air, the DDC controller shall increase the amount of fresh air and decrease the amount of return air through motorized dampers.

For diagnostic purposes, the DDC controller shall monitor/record the

fresh air, mixed air, supply air and return air temperatures through duct mounted temperature sensors. Similarly, the chilled and hot water supply and return temperatures shall be monitored/recorded. All this information will be available to HVAC plant operator in real time through software running on monitoring computer.

1-11.2 Air Handling Units for laboratories with DX-Condensing Units

AHU supply fan shall be energized by DDC controller either by operator command or as per programmed schedule. The supply fan shall be provided power through VFD. The status, alarm condition and power utilization data of VFD shall be monitored/recorded by the HVAC monitoring and control application.

A differential pressure switch (DPS) across AHU supply air fan shall monitor the discharge pressure. In case, no pressure differential is recorded by DPS when the supply fan is switched 'On', an alarm shall be generated and DDC controller shall shut down the AHU. The supply air fan failure alarm shall be promptly displayed on the screen of the monitoring computer, installed in the HVAC Control Room. The software application shall also show AHU status as 'OFF' due to supply air fan failure.

AHUs for labs have no return/mixed air module as 100% air from labs is being exhausted outside from conditioned space. A space temperature-humidity sensor shall be mounted in each lab for monitoring of these parameters in conditioned space.

The AHU has four-pipe system i.e. supply and return of chilled water and hot water to control temperature and humidity in the conditioned area.

During normal operation of the AHU, the DDC Controller shall monitor the temperatures of supply and return chilled and hot water. Accordingly, the chilled and hot water 3-way control valves shall be modulated.

Differential pressure switches (DPS) across AHU filters shall monitor the air pressure. In case, a pre-defined pressure differential is recorded by DPS, an alarm shall be generated to indicate dirty/clogged filter condition and the alarm shall be promptly displayed on the screen of the monitoring computer.

The DDC Controller shall compare the relative humidity of conditioned space, recorded by space temperature-humidity sensor, with the set value of the desired humidity. The chilled/hot water valves in conjunction with humidifier installed in the AHU will be modulated to control humidity of air conditioned space. The humidifier shall be switched ON/OFF while chilled/hot water valves shall be modulated. Duct type humidity sensors shall also be installed to monitor/record supply air humidity for diagnostic purposes.

A photoelectric type smoke detector, installed in return air duct, shall monitor the condition of air. In case of smoke detection, an alarm shall be generated and DDC controller shall shut down the AHU. The fire

alarm shall be promptly displayed on the screen of the monitoring computer. The BMS software application shall also show AHU status as 'OFF' due to fire alarm.

For diagnostic purposes, the DDC controller shall monitor/record the fresh air, mixed air, supply air and return air temperatures through duct mounted temperature sensors. Similarly, the chilled/hot water supply and return temperatures shall be monitored/recorded. All this information will be available to HVAC plant operator in real time through software running on monitoring computer.

In case of central air-conditioning system failure, the HVAC operator shall manually switch 'ON' the standby condensing unit with AHU. The status of the condensing unit shall be available for remote monitoring through BMS. Any issue/failure of the condensing unit shall be reported immediately to HVAC Plant Room operator through BMS Software.

1-11.3 Energy Recovery Ventilators with Cooling Coil

Energy Recovery Ventilators shall take air from building bathrooms and designated conditioned spaces to exhaust. The energy recovery section (coil-type) shall enable exchange of air properties between exhaust air and incoming fresh air. Furthermore, the incoming fresh air shall be further conditioned by passing through cooling coil. This conditioned fresh air shall be delivered to AHUs as fresh air to lower the load on AHU cooling coil.

The temperature and relative humidity of building exhaust air, incoming outside air, conditioned fresh air, and exhaust air being rejected to atmosphere shall be displayed on central HVAC computer.

Differential pressure switches (DPS) across ERV filters shall monitor the air pressure. In case, certain pressure differential is recorded by DPS, an alarm shall be generated to indicate dirty/clogged filter condition and the alarm shall be promptly displayed on the screen of the monitoring computer.

A photoelectric type smoke detector, installed in exhaust air duct, shall monitor the condition of air. In case of smoke detection, an alarm shall be generated and DDC controller shall shut down the ERV. The fire alarm shall be promptly displayed on the screen of the monitoring computer. The software application shall also show ERV status as 'OFF' due to fire alarm.

For diagnostic purposes, the DDC controller shall monitor/record the fresh air, exhaust air, supply air and return air temperatures through duct mounted temperature sensors. Similarly, the chilled/hot water supply and return temperatures shall be monitored/recorded. All this information will be available to HVAC plant operator in real time through software running on monitoring computer.

1-11.4 HVAC Plant Room

The temperature and humidity inside Plant room shall be monitored

through sensors installed in the Plant Room. Similarly, outdoor temperature and humidity shall also be monitored.

Electromagnetic type water flow meters shall be installed on the chilled water supply line to the building. The actual water flow rate shall be displayed by the flow meter for record/diagnostic purposes.

For diagnostic purposes, the DDC Plant controller shall monitor/record the chilled/hot water supply and return temperatures to/from the building.

Flow switches shall monitor the water flow in chilled/hot water lines. In case no flow is detected when the pumps are in 'On' condition, an alarm shall be generated.

All this information monitored by aforementioned sensors shall be available to HVAC plant operator in real time through software running on monitoring computer.

1-11.5 Chillers

Chillers shall be energized by controller either by operator command or as per programmed schedule. Chiller operation shall be synchronized with flow switches installed on chilled and condenser water lines. In case water flow is not detected, the chillers shall not be switched 'On'.

Chiller's built-in controller shall be integrated with IBMS. All the chiller data shall be visible to plant operator through monitoring software in addition to Chiller's built-in HMI. Real time monitoring of chiller's status/information shall also be made possible from monitoring software.

In case of any alarm condition, the information shall be promptly displayed on the screen of the BMS computer and chiller status shall be updated as per defined nomenclature.

1-11.6 Hot Water Generator

Hot Water Generators (HWG) shall be energized by controller either by operator command or as per programmed schedule.

HWG built-in controller shall be integrated with IBMS. All the HWG data shall be visible to plant operator through monitoring software in addition to HWG built-in HMI. Real time monitoring of HWG's status/information shall also be made possible from monitoring software.

In case of any alarm condition, the information shall be promptly displayed on the screen of the BMS computer and HWG status shall be updated as per defined nomenclature.

1-11.7 Chilled Water Pumps

Pumps shall be energized by controller either by operator command or as per programmed schedule. Pressure transmitters shall be installed

in the supply line header of pumps to building. The status and alarm condition shall be monitored/recorded by the IBMS application

A differential pressure switch (DPS) across each pump shall monitor the supply/discharge pressure difference. In case, no pressure differential is recorded by DPS when the pump is switched 'On', an alarm shall be generated and DDC controller shall shut down the pump. The pump failure alarm shall be promptly displayed on the screen of the IBMS computer. The IBMS software application shall also show pump status as 'OFF' due to failure. As per programmed sequence, the standby pump shall be energized by the controller/operator.

The pumps shall be operated alternatively as per defined time schedule/requirement so that each pump encounters similar wear and tear. The total service/operational time of each pump shall be recorded/logged in the IBMS software application.

1-11.8 Hot Water Pumps

Pumps shall be energized by controller either by operator command or as per programmed schedule. Pressure transmitters shall be installed in the supply line header of pumps to building. The status and alarm condition shall be monitored/recorded by the IBMS application.

A differential pressure switch (DPS) across each pump shall monitor the supply/discharge pressure difference. In case, no pressure differential is recorded by DPS when the pump is switched 'On', an alarm shall be generated and DDC controller shall shut down the pump. The pump failure alarm shall be promptly displayed on the screen of the IBMS computer. The IBMS software application shall also show pump status as 'OFF' due to failure. As per programmed sequence, the standby pump shall be energized by the controller/operator.

The pumps shall be operated alternatively as per defined time schedule/requirement so that each pump encounters similar wear and tear. The total service/operational time of each pump shall be recorded/logged in the IBMS software application.

1-11.9 Diesel Oil Day Tank

Oil level sensor installed on shall indicate the status of oil level in each tank. The sensors shall be configured to indicate low and high level as per the design requirements. BMS will monitor and generate alarm in case of low level.

1-11.10 Cooling Towers (CTs)

CTs shall be energized by controller either by operator command or as per programmed schedule.

Temperature sensors shall be used to monitor the supply and return line temperatures for each CT.

As per programmed temperature requirements of condenser water line, the DDC Controller shall switch On/Off the CT fans.

For each cell of CT, a current transducer shall monitor the flow of electricity through CT fan circuit. In case, no current flow is recorded when the CT fan is switched 'On', an alarm shall be generated and fan failure alarm shall be promptly displayed on the screen of the BMS computer. In case fan failure occurs simultaneously on second cell of the same CT, it shall be reported to the BMS Computer and DDC controller shall switch off the CT. The BMS software application shall show CT status as 'OFF' due to fans failure.

As per programmed temperature requirements of condenser water line, the DDC Controller shall switch On/Off the 2-way valves installed on inlet line of each cell of CT. When the temperature requirements are met, the CT fans shall be switched of sequentially and accordingly the corresponding 2-way valves installed on the inlet line to CTs shall be closed by DDC Controller. Simultaneously, the 2-way valve in the by-pass line shall be opened proportionally by the DDC Controller.

1-11.11 Condenser Water Pumps (CP)

Pumps shall be energized by controller either by operator command or as per programmed schedule. The pumps shall be provided power through VFDs. Pressure transmitters shall be installed in the supply line header of pumps to cooling towers. As per programmed pressure values, the power supply from VFD shall be adjusted to meet desired pump speed. The pressure in line shall be changed due to modulation of Cooling Tower 2-way control valve position. The status, alarm condition and power utilization data of VFD shall be monitored/recorded by the BMS application.

A differential pressure switch (DPS) across each pump shall monitor the supply/discharge pressure difference. In case, no pressure differential is recorded by DPS when the pump is switched 'On', an alarm shall be generated and DDC controller shall shut down the pump. The pump failure alarm shall be promptly displayed on the screen of the BMS computer. The BMS software application shall also show pump status as 'OFF' due to failure. As per programmed sequence, the standby pump shall be energized by the controller/operator.

The pumps shall be operated alternatively as per defined time schedule/requirement so that each pump encounters similar wear and tear. The total service/operational time of each pump shall be recorded/logged in the BMS software application.

The electric power consumed by each pump shall be shown by the respective power meter, installed on the MCC/ACP. The power meter shall be interfaced and integrated with HVAC monitoring software to record electrical consumption data.

1-11.12 Plume Fans

The plume fans shall be connected to VFDs and shall be turned ON/OFF through the VFDs.

A current switch across fans shall monitor the ON/OFF status. In case of fan failure, an alarm shall be generated on BMS computer.

The fans' status shall be monitored/recorded by the HVAC monitoring software.

Provision for switching ON/OFF the fans through DDC controller as per programmed logic or by operator command as per standard operating procedure shall be provided.

1-11.13 Protocol Level Integration of Independent Systems

The following systems shall be integrated with IBMS at protocol-level. The communication card/interface including any network gateways shall be provided by the respective suppliers of these systems:

1. Electrical System

i. Generators
ii. Energy Monitoring System

2. Elevators

3. Fire Alarm System

4. Fire Fighting System including Pumps and Tanks

5. Potable Water System including Pumps and Tanks

These systems shall have the provision to be controlled and monitored through IBMS Computer. Their respective parameters shall be displayed on IBMS Computer.

Generators: The generators shall have the provision to be turned on and off remotely through IBMS Computer. All relevant data such as Current, Voltage, Fuel Consumption, etc. on Generator controller shall be displayed and logged in IBMS Computer. Furthermore, any alarms generated pertaining to generators shall be visually (pop-up) as well as audibly produced on IBMS software.

Energy Monitoring System: The system shall display and log all its data through its built-in controller on IBMS Computer. The software shall have the provision to generate daily/weekly/monthly reports to monitor the energy parameters.

Elevators: The elevator controllers shall be integrated with IBMS in a manner to display all its parameters on IBMS Computer. These parameters are stated in the Technical Specifications for Elevator Works. Furthermore, upon engagement of Fire Alarm System, all elevators shall immediately move to Ground Floor, open their doors, and stop taking any calls from within and outside the elevator cabin.

Fire Alarm System: The IBMS shall have the capability to visually and audibly produce the fire alarm on its display in the event of Fire Alarm System engagement. Moreover, it should also display the exact location

of fire event to the IBMS Operator. The provision for data logging of such events shall also be provided in IBMS Software.

Fire Fighting System: The IBMS shall be able to display the On/Off and Trip/Fault Status of Fire Fighting Pumps. Additionally, low and high level of Fire Fighting Tank shall also be displayed on IBMS Computer. Any additional data available at Fire Fighting Panel shall also be displayed on IBMS Computer through protocol-level integration with its controller.

Potable Water System: The IBMS shall be able to display the On/Off and Trip/Fault Status of Potable Water Pumps. Additionally, low and high level of Potable Water Tanks shall also be displayed on IBMS Computer. Any additional data available at Potable Water Pumps Panel shall also be displayed on IBMS Computer through protocol-level integration with its controller.

1-12 DDC I/O POINT SUMMARY SHEET

An estimated summary of DDC Controllers' I/O point list is provided here. Actual I/O requirements shall be finalized in accordance with IBMS submittal after approval by Engineer.

	DESCRIPTION	AI	AO	DI	DO
A.	**AIR HANDLING UNITS (TYPICAL FOR EACH AHU) (8 NOS.)**				
1	Return/Supply Air Humidity	2	--	--	--
2	Return/Supply/Fresh/Mixed Air temperature	4	--	--	--
3	Pre-Filter DPS	--	--	1	--
4	Bag Filter DPS	--	--	1	--
5	Damper Actuation for Return Air	--	1	--	--
6	Fan DPS	--	--	1	--
7	Fan VFD	1	1	1	1
8	3-way control valve actuator for Chilled Water	--	1	--	--
9	3-way control valve actuator for Hot Water	--	1	--	--
10	Chilled Water Supply Temperature	1	--	--	--
11	Chilled Water Return Temperature	1	--	--	--
12	Hot Water Supply Temperature	1	--	--	--
13	Hot Water Return Temperature	1	--	--	--

14	Humidifier On/Off	--	--	--	1
15	CO_2 Sensor	1	--	--	--
16	Smoke Detector	--	--	1	--
17	Damper and motorized Actuator for Each Lab Area served by AHU	One Analog output for each Actuator			
B. AIR HANDLING UNITS WITH CONDENSING UNITS (TYPICAL FOR EACH AHU) (6 NOS.) FOR BSL LABS					
1	Return/Supply Air Humidity	2	--	--	--
2	Return/Supply/Fresh/Mixed Air temperature	4	--	--	--
3	Pre-Filter DPS	--	--	1	--
4	Bag Filter DPS	--	--	1	--
5	Air Dampers Actuation for Mixing Air	--	--	--	--
6	Fan DPS	--	--	1	--
7	Fan VFD	1	1	1	1
8	3-way control valve actuator for Chilled Water	--	1	--	--
9	3-way control valve actuator for Hot Water	--	1	--	--
10	Chilled Water Supply Temperature	1	--	--	--
11	Chilled Water Return Temperature	1	--	--	--
12	Hot Water Supply Temperature	1	--	--	--
13	Hot Water Return Temperature	1	--	--	--
14	Humidifier On/Off	--	--	--	1
15	CO_2 Sensor	--	--	--	--
16	Smoke Detector	--	--	--	--
17	AHU ON/OFF	--	--	--	1
18	Condenser Unit ON/OFF	--	--	--	1
19	AHU Trip/Fault Status	--	--	1	--
20	Condenser Unit ON/OFF Status	--	--	--	1

C.	**CENTRAL PLANT ROOM**				
1	Chiller Interface with IBMS (for Each Chiller) (3 nos.)	Open Protocol, preferably BACnet, based communication interface/card for control/ monitoring of Chillers through IBMS. Interface shall be configured for direct integration of each Chiller's Controller with IBMS.			
2	Hot Water Generator Interface with IBMS (for Each HWG) (3 nos.)	Open Protocol, preferably BACnet, based communication interface/card for control/ monitoring of Hot Water Generator through IBMS. Interface shall be configured for direct integration of each HWG's Controller with IBMS.			
3	Chiller Start/Stop	--	--	--	3
4	Chilled Water In/Out Temperature	6	--	--	--
5	Condenser Water In/Out Temperature	6	--	--	--
6	Water Flow meter (Electromagnetic LCD Display Type) – Control System Compatible for Chiller	Open Protocol, preferably BACnet, based communication interface/card for control/ monitoring of Water Flow Meter through IBMS. Interface shall be configured for direct integration of each Water Flow Meter's Controller with IBMS.			
7	Water Flow Switch for Chilled Water	--	--	3	--
8	Water Flow Switch for Condenser Water	--	--	3	--
9	Chilled Water Pump DPS	--	--	3	--
10	Hot Water Pump DPS	--	--	3	--
11	Condenser Water Pump DPS	--	--	3	--
12	Condenser Water Pump VFD	3	3	3	3
13	Power Meters/Analyzers with CTs for Chilled and Hot Water Pumps	Open Protocol, preferably BACnet, based communication interface/card for control/ monitoring of Water Flow Meter through IBMS. Interface shall be configured for direct integration of			

		each Power Analyzer.			
D.	**OIL LIFT PUMPS AND TANKS**				
1	Oil Lift Pump Start/Stop	--	--	--	2
2	Oil Lift Pump ON/OFF Status (CT Switch)	--	--	2	--
3	Oil Flow Meter	1	--	--	--
4	Oil Level Sensor	--	--	3	--
5	Pump status (Trip/Fault)	--	--	2	--
E.	**COOLING TOWERS (2-Cells each) (CTs) (3 NOS.) TYPICAL**				
1	Current Transducers for CT Fan	--	--	2	--
2	CT Fan Start/Stop	--	--	--	2
3	CT In/Out Water Temperature Sensors	2	--	--	--
4	2-Way Control Valves for CTs	--	1	--	--
5	Fan status (Trip/Fault)	--	--	2	--
F.	**PLUME FANS (5 NOS.)**				
1	Fan VFD	5	5	5	5
2	Fan CT Switch	--	--	5	--
3	DP Switch for HEPA Filter	--	--	5	--
G.	**ENERGY RECOVERY VENTILATORS (5 NOS.)**				
1	Return/Supply Air Temperature	10	--	--	--
2	Outside Air Temperature	5	--	--	--
3	Pre-Filter DPS	--	--	5	--
4	Bag Filter DPS	--	--	5	--
5	Supply Fan DPS	--	--	5	--
6	Return Fan DPS	--	--	5	--
7	Cooling Coil Supply Temperature	--	10	--	--
8	Cooling Coil Return Temperature	10	10	10	10
9	2-Way Control Valves	--	--	--	5

10	Smoke Detector	--	--	5	--
11	ERV ON/OFF	--	--	--	5
H.	**SMOKE VENTILATION FANS (2 NOS.)**				
1	Fan ON/OFF	--	--	--	2
2	Fan Trip/Fault Alarm	--	--	2	--
3	DP Switch for Fan Status	--	--	2	--
4	Dampers with Actuators	--	--	--	4

I.	**ELECTRIC GENERATORS**	
1	Generator Interface with IBMS	Open Protocol, preferably BACnet, based communication interface/card for control/ monitoring of Generators through IBMS. Interface shall be configured for direct integration of each Generator's Controller with IBMS.
J.	**ENERGY MONITORING SYSTEM**	
1	Energy Monitoring System Interface with IBMS	Open Protocol, preferably BACnet, based communication interface/card for monitoring of Energy Monitoring System through IBMS. Interface shall be configured for direct integration of Controller with IBMS.
K.	**ELEVATORS**	
1	Elevators Interface with IBMS	Open Protocol, preferably BACnet, based communication interface/card for control/ monitoring of Elevators through IBMS. Interface shall be configured for direct integration of each Elevator's Controller with IBMS.
L.	**FIRE ALARM SYSTEM**	
1	Fire Alarm System Interface with IBMS	Open Protocol, preferably BACnet, based communication interface/card for control/ monitoring of Fire Alarm System through IBMS. Interface shall be configured for direct integration of Main Fire Alarm Panel with IBMS.

M.	**FIRE FIGHTING SYSTEM (PUMPS AND TANKS)**	
1	Fire Fighting System Interface with IBMS	Open Protocol, preferably BACnet, based communication interface/card for control/ monitoring of Fire Fighting System through IBMS. Interface shall be configured for direct integration of each Fire Fighting System Controller with IBMS.
N.	**POTABLE WATER SYSTEM (PUMPS AND TANKS)**	

1-13 IBMS COMPUTER & ALLIED ACCESORIES

1-13.1 Branded Computer System with minimum configuration as follows:

1) Processor: Intel Core i7, 11th Generation or better.
2) Random-Access Memory: 16 GB.
3) 256 GB SSD
4) Hard-Disk Drive: 1 TB.
5) Two LED Monitors: 22 inches or higher
6) Keyboard: QWETRY.
7) Mouse: USB optical
8) Operating System: Microsoft Windows 11 (Professional) or better, compatible with IBMS software.

A color laser printer, with paper size upto A3, shall be provided for generating Reports from IBMS Software Application.

1-13.2 UPS (un-interruptible power supply) shall be supplied and installed at the front end incorporating complete IBMS Server and Screen. 1 KVA capacity, for a minimum of 1-hour backup.

26. Disaster Recovery (DR) Site for Sindh Forensic Science Laboratory, Karachi

Overview

The Disaster Recovery (DR) Site for the Sindh Forensic Science Laboratory, Karachi, shall be established to ensure continuity of critical forensic operations and protection of sensitive data in the event of system failure, natural disaster, or cyber incident. The DR Site shall serve as an alternate operational location equipped with essential IT infrastructure to replicate, safeguard, and restore SFSL's services with minimal downtime.

Proposed DR Infrastructure Components

1. Server System

An enterprise-grade server system shall be deployed to host core applications, databases, and virtual workloads required for business continuity.

Specifications:
2.5" Chassis with up to 12 SAS/SATA Drives, 2 CPU, 2 x Intel® Xeon® Gold Processor, 28C/56T or higher, 12 x 64GB RDIMM, 2 x 240GB SSD Hot-Plug, Dual, Hot-Plug, Fully Redundant Power Supply (1+1), Remote Access Controller supported, Dual Port 10/25GbE with SFP module, Quad Port 1GbE BASE-T Adapter, PCIe, Dual Port 10/25GbE with SFP module, PCIe, Rack mountable, Sliding Rails With Cable Management Arm.

Support and warranty for 1 year

2. Storage Solution

A secure and high-performance storage solution shall be implemented for real-time or scheduled data replication, backup, and quick recovery.

- **Specifications:**
  The unified storage requirement is divided into Structured and Un-structured data. The overall usable storage shall be minimum 200 TB Raw physical capacities and can be extendable up to 2 petabytes. 30% of the overall usable storage shall be used for structured data, 70% of the overall usable storage shall be used for Un structured data, It is recommended to have dedicated storages boxes for structured and un-structured data to achieve maximum performance. Symmetric Active Active Controllers (64 Cores), TLC NVMe SSD drives shall be provided in the Storage, shall support future expansion in NVMe, end to end NVMe, Should Support Active-Active Replication for SAN and NAS, The data communication link shall be minimum 25Gb, Dual controller offered storage should not have any single point of failure. Hot spare drives must be available for fault tolerance, Capacity planning chart must be shared with proposal. Minimum one hot spare drive per disk type must be proposed. Disk backend connectivity must be 25 Gbps or Higher,

Offered Storage shall support standard protocols FC, FCoE, iSCSI, to provide host connectivity. Redundant Power supply, Rack rails, must support Microsoft Windows Server 2012 and 2012 R2; Red Hat Enterprise Linux (RHEL) 6 and 7; SUSE Linux Enterprise Server (SLES) 11 and 12; VMware vSphere 5.1, 5.5, and 6.0. The contractor shall provide redundant SAN switches which shall be connected as per the data ports available in Servers and SANs. OM4 LC/LC multi-mode fiber cable patches 5 Meter or any other required Cables for data channel connectivity between Servers and SAN shall be provided accordingly.

Support and warranty for 3 years

The vendor should provide three (03) years warranty with 24 x 7 x 365 support with 4/8 hours SLA response time by Partner / OEM. The vendor should submit the proof of OEM's logistics center. Microcode of the Storage should be updated/upgraded by OEM. OEM should also have a local office for an emergency contact point.

3. Virtualization Platform

Virtualization Management Software (01 Instance)

The virtualization platform shall support efficient resource utilization, flexible recovery of services, and simplified management of virtual machines.

- **Specifications:**
  Proposed Solution must provide high availability / Redundancy for Virtualization Management Platform on DR Site in case of any disaster. Must support to create and manage local Users with Role Based Access and Permission Control, must provide Web Bowser based Management Console. Must provide complete visibility and centralized management / control of the Virtualization Platform. Must provide capability to scale up to 64 nodes or better.

  Compute Virtualization (04 Sockets)

  Proposed Solution should be highly redundant providing capability for the VMs to restart on another node in case of any Node failure in the Cluster, must provide VM Snapshot capability to revert back to previous point in time in case a failure or system error occurs, must provide VM Clone capability for creating cloned instances from source VM for testing or any other purposes. Must provide VM vMotion capability to Live migrate VMs to any nodes in the Cluster without any downtime, must provide the capability to automatically hot-add resources including vCPUs and Memory real-time based on VM contention. Must provide automated Resource Scheduling and Load Balancing capability for balanced performance on all nodes across the cluster. Must provide Distributed Switch capability to configure and administer switching for the entire Cluster. Must provide Hardware Health

Check capability to Monitor CPU, Memory, Network Interface Card, Hard Drive and RAID Controller etc.

It should be 100% compatible and integratrable with quoted storage and backup solution (Hardware + Software)

If software license is on subscription based, proposed solution must be provided with 03 years Ent level subscription

4. 12-Port Layer-2 Manageable Network Switch

A 12-Port Layer-2 manageable network switch shall be provided for reliable intra-network communication with VLAN, QoS, and remote management features.

- **Specifications:**

  1000 Base-T : 12 Ports ,
  1000 Base-X : 2 Ports
  1001 Bandwidth 112 Gbps
  1002 Non-blocking switching fabric

  2 x 10G ports in basic configuration, RAM 2 GB, MAC table 32 K, built in power supply, Front-to-Back or left to right cooling with complete installation, testing and minimum 1-year comprehensive warranty

5. Firewall

A next-generation firewall shall be installed to secure the DR environment from internal and external threats and to support secure VPN connectivity.

- **Specifications:**
  Next generation Firewall with throughput of 15 Gbps or higher with SFP and RJ45 port, dual redundant power supply, usb operator or console port, capable of web filtering, application control, IPs, URL filtering, anti pam, anti-malware, must Have Minimum 3.6 Gbps NGFW Throughput IMIX (FW + SA + IPS), must have Minimum 4 Gbps Threat Protection Throughput IMIX (FW + SA + IPS + Antivirus), IPsec VPN throughput ≥ 15 Gbit/s, must have Unrestricted Concurrent User, must have Minimum 1TB Storage Capacity, must Have Minimum 6 x 1G Ethernet Interfaces & 4x10G SFP+ Interfaces., must include Intrusion Prevention System (IPS), Anti-Virus & Anti-Malware, Email Security Protection, Web Filtering, Application Control, Bandwidth Management, Policy-based routing, RIP, OSPF, BGP, and IS-IS, minimum 100 Concurrent Users for SSL VPN, 3 year complete Security Features License, 3 year Software Upgrade & 24x7 Technical Support

  Point to Point (P2P) connectivity between Main SFSL Site and DR site

6. UPS 3 KVA

3 KVA UPS system shall be deployed to provide backup power, voltage regulation, and surge protection for critical DR equipment.

7. Allied Equipment

Allied equipment including server racks, cabling, PDUs, surveillance/access control systems, and environmental monitoring tools shall be included to support a fully operational DR setup.

- The Disaster Recovery Site for SFSL Karachi shall be designed to meet high standards of availability, security, and scalability. The infrastructure components listed above shall ensure seamless failover capability, data protection, and continuity of forensic operations in all emergency scenarios.

27. IP BASED PABX AND TELEPHONE SYSTEM

1 SCOPE

The work under this section consists of supplying, installing, configuring, programming, testing, commissioning and training of all material and services of IP PABX & Telephone System at SFSL. The system shall be complete in all respect as described in these specifications, drawings, B.O.Q and in accordance with industry standards with high reliability, fault tolerance, redundancy and high availability.

The Contractor shall discuss the deployment plan with the Engineer and co-ordinate at site for installation and configuration of IP PABX & Telephone System as per requirement provided by the engineer.

The preparation of shop/As Built drawings and low-level design is the responsibility of the Contractor. This specification and description is intended to set out the minimum requirements and it is expressly understood and agreed by the Contractor that anything which is usually furnished as a part of such installation as is called for in this tender and which is necessary for its proper completion, execution and function shall be furnished as a part of this specification without additional costs and extension of time whether or not shown in details on the drawings or described in particular hereinafter.

The technical documentation to be furnished by the Contractor shall include installation, testing & configuration plans, shop drawings, material/equipment submittals, as-built drawings, etc. as necessary for complete installation in light of the tender documents.

2 SYSTEM REQUIREMENTS

2.1 GENERAL

The IP PBX shall have an ultimate capacity of about at least 2000 telephone subscribers. This system shall share the infrastructure of the LAN and shall be based on an architecture offering security, reliability, scalability and shall offer future proof support for established, feature rich communications applications. All traffic shall be transported as packets over the LAN comprising active packet processing/switching equipment. The system shall be capable of being centrally monitored, configurable and manageable. The proposed architecture shall support:

2.2 SYSTEM INFRASTRUCTURE:

The IP PBX shall have duplicate control processor modules/cards operating such that failure of one will automatically, transfer control to the other without loss of functions.

The IP PBX of the proposed Voice Telephony System shall be a software application running on a dedicated IP enabled hardware PBX (private box exchange). For solutions where control is implemented in software, bidders shall describe how redundancy requirements are met with. In case of failure of one control module, the other redundant control module shall enable the IP PBX to be able to individually handle the total system traffic load without degradation in service.

The system should be fully digital and the transmission must conform to the ITU-T recommendations for PBX systems and shall primarily use PCM coding according to the A-law (ITU-T rec. G.711 and G.712).

All voice nodes on each floor shall be connected to Access Switches (PoE) placed on respective floors and zones via UTP Cat-6 cables. These access switches shall be connected to Core Switch via Distribution switch and shall have fibre connectivity with IP PBX (Gateway). All Analog & SIP trunks from the service provider shall be dropped on Gateway (IP PBX).

These SIP trunks shall than be configured as per requirement for direct lines and extensions provisioning on each floor as per client requirement. Direct call facility apart from extensions shall be provided to all the Higher Management on each floor of the building and this feature shall be software enabled on IP PBX. Higher Management shall be provided with IP Executive Phones while all remaining staff of the building shall be provided with Analog phones.

3 ACTIVE & PASSIVE COMPONENT DETAIL:

This section outlines the essential components (active & passive components) of IP PABX & Telephone system network in the envisioned solution:

3.1 Active Components:

3.1.1 Voice Solution:

Hybrid PABX having Capacity 500 lines (300 Analog, 100 IP system ports, 2 PRI, SIP (standard ports) 50 Ports, SIP plus version 25 Ports, SIP (Video version) 25 Ports, including Power Supply for allows operation at power failure for minimum 3 HOURS.

3.1.2 Software of IP PABX:

More than 2000 subscribers, Auto Provision, Certified as private branch exchange, rural, city, trunk line, combined and international telephone exchange, Virtual PBX, Call center, Teleconference, Support for Session border controller functions, Support for a wide range of VAS (Value Added Services), Geographic redundancy, Local redundancy, Load balancing, Flexible IVR builder, Monitoring and management, Support for widely used CRM systems, integration with customer CRM, Operation under KVM and VMa Ware, Support for TTS (Text to speech) and ASR (Automatic speech recognition)

3.1.3 Reception Operator Console:

14 fixed function keys dedicated to basic and enhanced, 10 Soft Keys that control access to the attendant features, Multiple call hold positions and line appearances, Intelligent Directory and Live Content Suite applications support, Secure Call Recorder Connector (SCRC) support as well as standard Record-a-Call functionality, Two integrated headset / handset jacks, Dual-port IP console (10/100 MB) switched, Ethernet) – connect a computer and a console, Operating Temperature: +4°C to +45°C, Relative Humidity: Up to 95%

3.1.4 16 Port Access Switch:

1000 Base-T: 16 Ports, 1000 Base-X: 2 Ports, Bandwidth 112 Gbps, Non-blocking switching fabric, 4 x 10G ports in basic configuration, L3 functions, RAM (DDR3) 512 MB, ROM (RAW NAND) 512 MB, MAC table 32K, stacking up to 8 devices, Built-in power supply, Dual ventilation system, Front-to-Back or left to right cooling

3.1.5 Access Switches layer 2 with SFP Managed:

Fixed configuration PoE+ enabled manageable layer-2 switch with Rack Mount Kit, 24-Ports 10/100/1000 Mbps RJ-45 interface for connectivity over UTP, 2 x1G Ports for uplink connectivity (SFP Interface), 802.3af compliant built-in power supply, support PoE cameras with power budget of 400W, RAM should be 2GB, power cable, installation, configuration & testing with standard manufacturer warranty.

3.1.6 48 Port Access POE with SFP Managed:

Fixed configuration manageable layer 2 PoE switch, 48 x 10/100/1000Base T Ports, 4 x 10 GE SFP ports for SFP based uplink connectivity over fibre optics, switching capacity 176 Gbps or higher, 2 GB RAM, support 802.1X authentication, MAC address authentication, support multiple VLANs, ACL, with complete installation, testing and minimum one-year comprehensive warranty. Warranty Period shall start after signing of Handing Over/Taking Over Certificate.

3.1.7 Core Switch Layer 3:

Stackable fixed configuration manageable Layer 3 Switch, Switching capacity: 1.92 Tbit/sec or higher, Optical interface: 24SFP Plus+ ports, 4QSFP Plus ports, (Optical interface 10GE ports, 40GE ports or 100GE ports card are supported), dual power supply, power cable, hot swappable redundant fans , Multi-layer switching and enhanced routing capability, Support of RIP, OSPF, DHCP snooping, Support ARP entries of 140K, Support multicast traffic, Software based fault tolerance, MAC Address entries should be minimum 200K, QoS and Filtering, Multi-layer switching and enhanced routing capability, Support multiple VLANs, Security features: 802.1x, Access Control Lists (ACLs), SNMP enabled, remote monitoring, Telnet support, Web based management interface with complete installation, configuration, testing and minimum one-year comprehensive warranty

3.1.8 IP Executive Phone:

Power over Ethernet (PoE), 2 SIP accounts, Auto provision (TR-069, DHCP), Headset connection, Large LCD display, 3.2 inch (81 mm) backlit monochrome display, 128x64 resolutions, 6 programmable keys, Local 3 Way-conference

3.1.9 Analogue Phone with CLI:

Adjustable ringing volume, Adjustable Voice level, DTMF Dialling, Headset, Mountable on wall or desktop, Relative Humidity: up to 90%

3.2 Passive Equipment:

3.2.1 50 pair Sub-Main Telephone Junction Boxes:

(SMTJB) made with 16 SWG sheet steel housing, powder coated paint of approved colour, consisting of specified Distributor Blocks / Tag Blocks for incoming and outgoing PTCL lines from ONU. Item includes all interconnecting jumper wiring and termination.

3.2.2 100 pair Sub-Main Telephone Junction Boxes:

(SMTJB) made with 16 SWG sheet steel housing, powder coated paint of approved colour, consisting of specified Distributor Blocks / Tag Blocks for incoming and outgoing PTCL lines from ONU. Item includes all interconnecting jumper wiring and termination.

3.2.3 Main Distribution Frame (MDF) - (500 Pair wiring tag blocks)

3.2.4 Main Distribution Frame (MDF) - (200 Pair wiring tag blocks)

3.2.5 UTP CAT-7 for IP Phone

IEEE802.3 10G Base-T, 23AWG Cable for Data Communication System from switch to each node/ outlet in 25 mm PVC conduit / channel including termination and tagging at both ends. Complete in all respects.

3.2.6 50 Pair, copper conductor cable for Telephone System to be installed in Conduit. complete in all respects.

3.2.7 25 mm PVC Conduit including Tees, Elbows, Joint Boxes etc complete in all respect

4 APPLICABLE STANDARDS AND CODES

The latest editions of the standards/codes shall be applicable.

5 DRAWINGS (SHOP, AS-BUILT)

The Contractor shall prepare shop drawings and submit for approval prior to start of cable laying process. As-built drawings shall be prepared by the Contractor after the successful testing of the cabling infrastructure.

6 INSTALLATION REQUIREMENTS

Installation of all equipment shall require close coordination between the Contractor and the Client personnel. The contractor shall ensure that the cabling and crimping/termination of installed equipment shall be done in accordance with the industry standards and supported by the Original Equipment Manufacturer (OEM).

7 TESTING & COMMISSIONING

The contractor shall make necessary arrangement including tools, access etc for scheduled site inspections.

8 TRAINING

The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant. However, two levels of training shall be imparted; user level and administrative/advanced level.

9 DOCUMENTATION

The contractor shall provide technical documentation that includes all layouts, calculations, workshop/ shop drawings, material/equipment submittals, as-built drawings, etc. which are necessary for complete installation in light of the tender documents. All user manuals shall be provided to the Client.

10 WARRANTY & MANAGED SERVICES

The Contractor shall provide one-year on-site warranty (the warranty period should start after installation and handover) and managed services of all equipment. During this period, it will be the responsibility of the Contractor to rectify any defects and provide services such as preventive maintenance, configuration of equipment, problem rectification within the permissible downtime and backup equipment inventory. The necessary patches, upgrades and updates as and when released by the original supplier shall also be provided during the warranty period so as to ensure that the system is functioning to provide the best performance.

SECTION – 8377

28. QUEUE MANAGEMENT SYSTEM (QMS)

1 SCOPE

The work under this section consists of supplying, installing, configuring, testing, commissioning and training of all material and services of complete Under Queue Management System (QMS). The system shall be complete in all respect as described in these specifications, drawings, B.O.Q and in accordance with International Organization for Standardization (ISO) and Telecommunications Industry Association (TIA) recommendations.

The Contractor shall discuss the cabling layout with the Engineer and co-ordinate at site for exact locations and positions of the Queue Management System equipment and routing of cables etc.

The preparation of shop/As Built drawings and low level design is the responsibility of the Contractor. This specification and description is intended to set out the minimum requirements and it is expressly understood and agreed by the Contractor that anything which is usually furnished as a part of such installation as is called for in this tender and which is necessary for its proper completion, execution and function shall be furnished as a part of this specification without additional costs and extension of time whether or not shown in details on the drawings or described in particular hereinafter.

The technical documentation to be furnished by the Contractor shall include installation, testing & configuration plans, shop drawings, material/equipment submittals, as-built drawings, etc. as necessary for complete installation in light of the tender documents.

2 SYSTEM REQUIREMENTS

2.1 GENERAL

Queue Management System shall be installed which will facilitate police officials who will be visiting science laboratory for submission of evidence collection.

2.2 QUEUE MANAGEMENT SYSTEM INFRASTRUCTURE

On arrival, they will get receipt from installed kiosk and wait for their turn. When their number will be announced from the central desk, they will move to the designated location.

The logical diagram of Queue Management System is shown in Figure 1.1.



Fig 1.1: Logical diagram of Queue Management System

3 ACTIVE & PASSIVE COMPONENT DETAIL

3.1 17"COLOR LED WITH TOUCH PAD KIOSK TICKET DISPENSER

17" color LED with Touch Screen kiosk Ticket Dispenser, Multi language/ English printing, Transmitting way: Ticket Number : 0001-9999, Built in Thermal Printer, floor stand, Resolution: 1280 X 1024 pixels, TCP/IP, with software and customized reports, Temperature: 10-40 ºC with complete installation, configuration, testing and minimum one year comprehensive warranty

3.2 DIGIT QUEUE DISPLAY COUNTER

Digit Queue Display Counter, Display called ticket number, counter number, Show numeric information such as waiting time and number of people in line, Scroll text in any direction, 300 mm wide, Operating temperature:-10 to 40 degree, with complete installation, configuration, testing and minimum one year comprehensive warranty

3.3 CONTROLLER HUB

Manage the connection between Server and other QMS Hardware to manage a system with up to 30 counters, RJ 45 with complete installation, configuration, and testing and minimum one year comprehensive warranty

3.4 VOICE ANNOUNCEMENT MACHINE

Voice announcements for directing customers, Stores up to 6 hours of CD-quality stereo voice files, Volume Control, TCP/IP, Built in Power Amplifier, Operating temperature: 10 – 40°C, Storage capacity > 4 GB, Supported file formats riff wav (pcm), .mp3, support Urdu and English as a language in Voice, Connectable with Counter Display & Waiting area Display with complete installation, configuration, testing, and minimum one year comprehensive warranty

3.5 55” WAITING AREA DISPLAY LED TV

55” Full HD LED TV, Player Device (Android) , Flash Ticket number, counter number, show videos and images, Connectable with Management Software with complete installation, configuration, testing, and minimum one year comprehensive warranty

3.6 QUEUE MANAGEMENT SOFTWARE

Queue Management Module: Addition, Queue Depth settings, Deletion of tickets within queue etc.

Services Management module: Addition, deletion, updation, time bound services, Assignment of queues with services etc.

Ticket Management Module: Ticket designing and formatting, Ticket Contents updation/deletion/addition etc.

Reporting Module: includes all reports related to queues, services, tickets, Performance management based on multiple criteria.

Counter Management Module: Addition/Deletion/updation of users/managers/system administrators, Assignment of counters to User etc.

3.7 USER/ CALLING SOFTWARE

Call next customer, Transfer Ticket No, Select Priority, Change Priority, Staff login, Customizable Layout & Buttons

3.8 SERVER FOR MANAGEMENT SOFTWARE

Core i7 11th generation or above, 16M Cache, minimum 3.6 GHz, 16 GB DDR4 RAM, 1 TB 7200 RPM HDD,100/1000 Mbps integrated Gigabit LAN & Wireless LAN card , FHD 21.5-inch LED display monitor, USB Keyboard & Mouse, pre-installed windows 10 or higher

3.9 DESKTOP COMPUTERS

Core i7 9th Gen or higher, 2.8 GHz base frequency or higher, Mother Board: Intel, 4GB DDR4 Ram, 1TB HDD, USB Wired Keyboard, USB 2.0 Optical Mouse with Scroll, LED Monitor 19", Built-in Gigabit Ethernet LAN , licensed Windows 10 Pro

4 APPLICABLE STANDARDS AND CODES

The latest editions of the following standards/codes shall be applicable for the materials covered within the scope of this section:

TIA/EIA 568-B.1, B.2, B.3:	Telecommunications Cabling Standard
TIA/EIA 569-A:	Commercial Pathways and Spaces
TIA/EIA 606:	Standard for Telecom Infrastructure
ITA/EIA 758:	Outside Plant Cabling Standard
ISO/IEC 11801:	Generic Cabling for Customer Premises
DIN 40040:	Class and Reliability of Units in Telecommunication

5 DRAWINGS (SHOP, AS-BUILT)

The contractor shall prepare shop drawings to indicate location of Queue Management System equipment, cable routes etc. keeping in view the actual site conditions and submit for approval prior to start of cable laying process. As-built drawings shall be prepared by the Contractor after the successful testing of the cabling infrastructure.

6 INSTALLATION REQUIREMENTS

Installation of all equipment shall require close coordination between the contractor and the Client personnel. Queue Management System Equipment exact location shall be submitted for Consultant/Engineer Incharge's approval. The contractor shall ensure that the cabling and crimping/termination of installed equipment shall be done in accordance with the industry standards and supported by the Original Equipment Manufacturer (OEM).

7 TESTING & COMMISSIONING

The contractor shall make necessary arrangement including tools, access etc. for scheduled site inspections. The reports shall be submitted to the Client after successful completion of testing/commissioning phase.

All the active equipment shall be tested & commissioned by the Contractor as per the approved test/commission plan by the Consultant/Engineer Incharge.

8 TRAINING

The contractor at his own cost shall impart training to the nominated staff. The detailed content shall be finalized by the client in consultation with the consultant.

However, two levels of training shall be imparted; user level and administrative/advanced level.

9 DOCUMENTATION

The contractor shall provide technical documentation that includes all layouts, complete labeling scheme, workshop/ shop drawings, active equipment configuration detail, as-built drawings, etc. which are necessary for complete installation in light of the tender documents. All user manuals shall also be submitted.

10 WARRANTY & MANAGED SERVICES

The Contractor shall provide comprehensive one year on site warranty and managed services of all active equipment. During this period, it will be the responsibility of the Contractor to rectify any defects and provide services such as preventive maintenance, configuration of equipment, problem rectification within the permissible downtime and backup equipment inventory. The necessary patches, upgrades and updates as and when released by the original supplier shall also be provided during the warranty period so as to ensure that the system is functioning to provide the best performance.

SECTION – 8337

29. PERIMETER INTRUSION DETECTION SYSTEM (PIDS)

01 SCOPE OF WORK

The scope under this section consists of site survey, detail engineering design, supply, installation, configuration, programming, integration, testing, commissioning and training of all materials and services of the complete Perimeter Intrusion Detection System (PIDS) as specified herein, shown in the Drawings and stated in the Schedule of Prices.

The Perimeter Intrusion Detection System (PIDS) with accessories shall also comply with General Technical Requirements for Security Monitoring & Control System and with other relevant provisions of the Contract Documents.

02 GENERAL

PIDS shall be able to detect intrusion at multiple locations simultaneously and provide exact location on perimeter.

Fixed and long-range PTZ CCTV cameras installed all along perimeter boundary and shall interface with the perimeter intrusion detection system.

Video analytic CCTV cameras shall interface with the PIDS. CCTV cameras shall capture real time video of intruder movement and give alarm in the Command & Control Room.

Perimeter intrusion detection system shall integrate with video management software of CCTV system.

03 ELECTRIC BASED PIDS:

- This security layer covers perimeter with electric fence installed on top of boundary wall of 3 feet or as available at site with alarm control equipment including but not limited to dual zone energizer with built in UPS, maintenance free battery, keypad controller, shielded insulators, tensioners hooks, stainless steel poles, stainless steel support pipes, strands wires, wiring sign plats, indication flash light, siren, earth spikes, cables as required as per manufacturer, 1.2/1.6mm stainless steel wire, weather proof type NEMA 4X IP67 rates enclosure suitable for corrosive environment including all interconnection equipment complete in all respect as per the recommendation of the proposed manufacturer.

- The LCD display on the dual energizer shall provide information on the status and performance of the energizer. It maximizes the power on the fence and minimizes false alarms.
- Dual energizer shall have following minimum requirements:

    - Two independently monitored and controlled zones.

    - Each zone shall be set independently to be on/off or in high/low voltage modes.

    - Shall be programmed in to alarm sensor mode

    - Built-in alarm monitoring tampering or faults on the high voltage and earth fence wires.

- Lighting and power surge protection
- Intelligent power saving to extend battery life.
- Shall be powered by 220V mains and include a built-in battery for back-up powers.

- To ensure absolute security, controller shall continuously monitors the Electro-Fence for different types of attack and generates an alarm when pre-programmed conditions are met.
- Electro-Fence System shall interface with security equipment such as IP CCTV etc.
- Electro fence controllers shall be available in single, dual or multi zone type which shall be fence mountable.
- Electric fence shall have minimum but not limited to following features:
  - Visual & physical intruder deterrent
  - Shock, voltage & short circuit monitoring
  - Cut & climb monitoring
  - Controller continuous monitoring
  - Interfaces with standard security equipment

Technical Material Data:

Electric PIDS shall include but not limited to the following:

- Dual zone energizer
- Maintenance free battery
- Keypad controller
- Shielded insulators
- Tensioners hooks
- Stainless steel poles
- Stainless steel support pipes
- Indication flash light
- Siren
- Earth rod
- Cables as per manufacturer
- 1.2/1.6mm stainless steel wire
- Weather proof NEMA 4X, IP 67 rated enclosure
- all interconnection equipment
- PC & Software

- Electro-Fence System shall be monitored and controlled via LCD keypads or it shall be controlled from a PC installed in control room (s) using the security management system software.
- Alarms shall be shown on maps of the site and all zones shall be controlled from the PC from control rooms. The voltage on each section of the fence shall be displayed on PC in real time.

05 INSTALLATION

Installation of Perimeter Intrusion Detection System (PIDS) shall be done in strict accordance with the manufacturer's recommendations.

06 **TRAINING**

A training session shall be presented by a fully qualified, trained representative of the equipment manufacturer/supplier who is thoroughly knowledgeable of the specific installation. The training shall be given to personnel responsible for operation and maintenance of the system.

SECTION – 8341

30. PUBLIC ADDRESS/VOICE EVACUATION SYSTEM

1.0 SCOPE OF WORK

The work under this section consists of supply, installation, connecting, configuring, programming, testing, commissioning and training of all equipment, material, accessories and services for Public Address and Voice Evacuation System shall be complete in all respect as described in these specifications, drawings, B.O.Q and in accordance with International Organization for Standardization (ISO).

The Contractor will discuss the Public Address and Voice Evacuation System layout with the Engineer and coordinate at site with other services for exact route, location and position of electrical / telecommunication lines and equipment.

The Public Address and Voice Evacuation System with accessories shall also comply with the General specifications for Electrical Works, General Technical Requirements for Communication Works and with other relevant provisions of the Contract Document.

2.0 GENERAL

Public Address & Voice Evacuation System shall be provided as shown on drawings.

Public Address & Voice Evacuation system shall interface with the Fire Alarm System in accordance with NFPA 72 and British Standard BS5839-8: 2013 or latest version of the same.

All the active items of the Public Address & Voice Evacuation System shall be listed as a product of a single manufacturer.

The system shall make use of modular design to enable future enhancements.

Contractor shall submit Sound Pressure Level (SPL) calculation of speakers for review.

Contractor shall consider 75-80 dB as background noise level for calculation of Sound Pressure Level (SPL) of speakers.

A feedback circuit arrangement shall be provided to keep sound pressure levels at least 10 db above background noise.

A supervisory system shall monitor loudspeaker loop for open circuits, short circuit and earth leakage conditions.

Announcement facility shall be provided at Command & Control Room of Main Building.

Also, Provision for announcement shall be provided at following locations:

- Evidence Block
- Reception Block.

Configuration of the system for microphone control and priority setting shall be as follows:

- The highest priority input shall be used for emergence addressing from P.A. announcer console installed in Command & Control Room.

- The second priority shall be provided to microphone installed at Evidence Block / Reception Block.

Power amplifier outputs shall be of the 100 V type. The equipment rack shall be connected to the UPS.

It shall be possible to combine the zones of within floor and each floor into a group for simultaneous broad casting.

All equipment, cables and wires shall be numbered in accordance with the standardization procedures laid down in IEC 750.

Contractor shall point by point confirm in writing their compliance with the items of this specifications in the form of a qualified statement of compliance.

Materials furnished under this specification shall be standard product of manufacturers, regularly engaged in the production of such equipment. Manufacturer shall also have authorized representative in Pakistan for maintenance of the equipment.

All junction boxes, glands (if required) shall be provided and price shall be deemed included in respective BOQ Item.

3.0 APPLICABLE STANDARDS AND CODES

EN54, CE, DIN EN 60268-5 and DIN 45589 shall be applicable for the material covered within the scope of this section.

4.0 MATERIAL

4.01 System Manager / Network Controller with Software:

The System Manager with input and output as shown on the drawing and required as per manufacturer’s recommendation shall be provided. Required Matrix Zones Bus shall be modular and shall have the following minimum characteristics:

- Indication — Available
- LAN — Available
- Control Input — 8 inputs minimum

- Control Output — 5 output minimum
- Audio Input — 2 input
- Standby Amplifier Input — 1 x input, 1 x output
- Distortion: — Less than 1% (at rated output f = 1 kHz Sine wave)
- Emergency Power Supply — Available

System Manager Component shall have a provision of 25% spare capacity in main console including emergency power supply in order to cater future PA equipment requirement.

4.02 **Amplifier (Compatible to System Manager)**

Contractor shall provide dedicated duty amplifier for each zone as specified in load calculation chart in public address & voice evacuation schematic diagram as per their proposed manufacturer.

1 Nos. of auto standby amplifier of highest wattage shall also be provided and cost of all duty and spare amplifiers shall be deemed included in respective BOQ item.

The power amplifier shall have the following characteristics:

- Rated Output Power: — As per zone load calculation given in PA schematic diagram.
- Output Voltage — 100 V
- Inputs and Outputs: — Available

4.03 **Mixer Amplifier for Mosque**

The mixer amplifier shall have the following characteristics:

- Rated Output Power: — As per design requirement
- Inputs and Outputs: — Available
- Feedback Suppressor — Available

4.04 **Horn Loudspeaker**

Weather Proof Horn Loudspeaker suitable for mounting on wall brackets shall be used wherever required. Speakers shall be installed with junction box, ceiling rose, driver unit, glands, integrated 100 V-matching transformers and wall mount bracket for which price shall be deemed included in their respective BOQ item.

Horn Loudspeaker shall have following minimum technical specification.

- Rated output power: 15 watt
- Frequency Response: 120 Hz – 15 kHz
- Sensitivity / SPL: 97 dB (1 W, 1 m)
- Rated Voltage: 100 volts.
- IP Rating: IP67 Rated

4.05 **Horn Loudspeaker**

Weather Proof Horn Loudspeaker suitable for mounting on wall brackets shall be used wherever required. Speakers shall be installed with junction box, ceiling rose, driver unit, glands, integrated 100 V-matching transformers and wall mount bracket for which price shall be deemed included in their respective BOQ item.

Horn Loudspeaker shall have following minimum technical specification.

- Rated output power: 15 watt
- Frequency Response: 120 Hz – 15 kHz
- Sensitivity / SPL: 97 dB (1 W, 1 m)
- Rated Voltage: 100 volts.
- IP Rating: IP65 Rated

4.06 **Ceiling Loudspeaker for General Areas**

Ceiling Loudspeaker shall be provided as per requirement. Speakers shall be installed with fire dome, junction box, ceiling rose, driver unit, glands, integrated 100 V-matching transformers and other required accessories for which price shall be deemed included in their respective BOQ item.

Ceiling Loudspeaker shall have following minimum technical specification.

- Rated Power 6 watt
- Rated Voltage 100 volts.
- Frequency Range 160 Hz – 13 kHz

- Sound Pressure Level (SPL) 90 dB (1 W, 1 m)

4.07 **Ceiling Loudspeaker for Mosque**

Ceiling Loudspeaker shall be provided as per requirement. Speakers shall be installed with junction box, ceiling rose, driver unit, glands, integrated 100 V-matching transformers and other required accessories for which price shall be deemed included in their respective BOQ item.

Ceiling Loudspeaker shall have following minimum technical specification.

- Rated Power 6 watt
- Rated Voltage 100 volts.
- Frequency Range 45 Hz – 20 kHz
- Sound Pressure Level (SPL) 96 dB (1 W, 1 m)

4.08 **Remote Microphone**

The remote microphone shall have the following characteristics:

- Distortion: Less than 1%
- Frequency Response: 100 Hz – 20 kHz
- Signal to Noise Ratio (S/N) ≥ 60 dB

4.09 **Headgear Microphone for Mosque**

The headgear microphone shall have the following characteristics:

- Directivity Unidirectional
- Frequency Response: 50 Hz – 12 kHz

4.10 **Unidirectional Dynamic Microphone for Mosque**

The dynamic microphone shall have the following characteristics:

- Directivity Unidirectional
- Frequency Response: 70 Hz – 15 kHz
- Floor Stand Included in respective BOQ item

4.11 **Loudspeaker Cable**

Wiring and cabling of loudspeaker cable shall be carried out in PVC/G.I conduits as required. 2 x 1.5 mm^2 fire resistant enhanced cable with LSZH

outer sheath / manufacturer's recommended cable shall be provided for the wiring of loudspeaker cable for Public Address System / Voice Evacuation System. The cable shall be able to work for 120 minutes in fire condition.

All wires and cables shall be checked for open, short or ground faults. All wiring shall be made on terminal blocks of proper size and type for the services involved. Cable joints shall only be allowed on the speaker junction boxes. Appropriate size nos of cable glands and junction boxes shall be provided for speakers.

4.12 Paging Microphone Cable

Wiring of microphone cable shall be carried out in PVC/G.I conduits as required. Manufacturer's recommended cable shall be provided for the wiring of microphone of Public Address and Voice Evacuation System.

4.13 Remote Microphone Cable

Wiring of microphone cable shall be carried out in PVC/G.I conduits as required. Cat 6 STP LSZH cable / manufacturer's recommended cable shall be provided for the wiring of remote microphone of Public Address and Voice Evacuation System.

4.14 Public Address and Voice Evacuation Rack

Cabinet shall be 19 inch, with tie and retainers for cabling system and 600mm x 600mm, 800mm x 600mm and 1000mm x 800mm cabinet shall be suitable to install:

- Colour of rack: Black.
- Plexi glass door.
- Frame thickness 2mm, mounting rail thickness 2mm, roof thickness 1.63mm, rear door thickness 1.63mm and side panels thickness 1.2mm.
- At least two cooling fan.
- Cable entries from both top and bottom panel.
- Cabling guide system in each internal side of cabinet for front and back side.
- Earthing / grounding point.
- Door lock with key locking capacities.
- Right or left opening of door of rack shall be provided as per requirement of room.
- A cabling guide system in each internal side of the cabinet for the front side;
- A cabling guide system in each internal side of the cabinet for the backside;
- An earthing point, multi-socket strip for supply power to the active equipment;
- Metallic door shall be provided with key locking capabilities.

Power distribution unit (PDU) must have following specification:

- At least two extra sockets as per requirement of active equipment installed inside rack.
- PDU with sockets compatible with active equipment
- Industrial male plug / compatible with power socket.
- Two PDUs in each rack for active equipments that have dual power supply.

5.0 TRAINING

A training session shall be presented by a fully qualified, trained representative of the equipment manufacturer/supplier who is thoroughly knowledgeable of the specific installation. The training shall be given to personnel responsible for operation and maintenance of the system.

6.0 INSTALLATION

6.1 Voice Evacuation System Equipment

The installation of Voice Evacuation System Equipment shall be in strict accordance with the manufacturer's instructions/recommendations and these specifications.

The testing of Voice Evacuation System equipment shall be in compliance with the relevant standards and regulations. During testing of equipment, emphasis shall be laid on the following:

- Zone wise and group wise microphone live broadcast routing
- Microphone priority testing

6.2 Wiring and Cabling

Wiring and cabling of Voice Evacuation System shall be carried out as per instructions given in Section 8212 'Low Tension Cables' of these specifications.

6.3 Conduits and Accessories

Conduits and accessories for Voice Evacuation System shall be installed as per instructions given in section 'Conduits and Pipes', of contact specifications.

7.0 MEASUREMENT AND PAYMENT

7.1 General

The Contractor's bid amount against each Bill of quantities item as given below shall include supply, installation, testing, commissioning and

completion of all work specified herein and/or as shown on the Contract Drawing related to the item.

7.2 **System Manager with required Matrix Bus with Software etc.**

7.21 **Measurement:** Measurement shall be made for System Manager with required Matrix bus with 25% spare capacity having microprocessor modular matrix, input card, output card, LAN connectivity, dedicated duty amplifier for each zone as mentioned in load calculation sheet in schematic diagram, auto standby amplifier of highest wattage, automatic switchover, line fault detection system, manufacturer's recommended emergency power supply backup with DC power output, trickle charging, with suitable manufacturer's recommended backup batteries as required, PA software, SPL calculations, interfacing with fire alarm system including any other essential interconnecting equipment and cabling as required with all installation and mounting accessories for satisfactory operation of the entire public address & voice evacuation system acceptably supplied and installed by the Contractor as a complete job.

7.2.2 **Payment:** Payment shall be made for the complete job measured as provided above at the contract unit price and shall constitute full compensation for supplying, installing, connecting, configuring, programming, testing, commissioning and completion of System Manager with required Matrix bus with 25% spare capacity having microprocessor modular matrix, input card, output card, LAN connectivity, dedicated duty amplifier for each zone as mentioned in load calculation sheet in schematic diagram, auto standby amplifier of highest wattage, automatic switchover, line fault detection system, manufacturer's recommended emergency power supply backup with DC power output, trickle charging, with suitable manufacturer's recommended backup batteries as required, PA software, SPL calculations, interfacing with fire alarm system including any other essential interconnecting equipment and cabling as required with all installation and mounting accessories for satisfactory operation of the entire public address & voice evacuation system.

8.1 **Horn Loudspeaker / Ceiling Loudspeaker with Matching Transformer**

8.01 **Measurement:** Measurement shall be made for the total number of each type of Horn Loudspeaker/Ceiling Loudspeaker acceptably supplied and installed by the Contractor as complete unit.

8.02 **Payment:** Payment shall be made for the complete unit as provided above at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of each type of Horn Loudspeaker / Ceiling Loudspeaker complete with driver unit, integrated matching transformer, fire dome and wall mount and ceiling mount

brackets as specified in BOQ and specification including all mounting and installation accessories as required complete in all respect.

8.2 **Remote / Headgear / Unidirectional / Dynamic Microphone**

8.21 **Measurement:** Measurement shall be made for the total number of each type of Remote / Headgear / Unidirectional / Dynamic Microphone acceptably supplied and installed by the Contractor as complete unit.

8.22 **Payment:** Payment shall be made for the complete unit as provided above at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of each type of Remote / Headgear / Unidirectional / Dynamic Microphone as specified in BOQ including all mounting and installation accessories.

8.3 **Public Address Rack**

8.31 **Measurement**: Measurement shall be made for the total number of each type of Public Address Rack for installation of system manager, power amplifier, and accessories of public address system and terminal strips for speaker circuits and microphone, earthing point, multi-socket strip for supply power to the amplifier, Plexi glass door with key locking capabilities acceptably supplied and installed by the Contractor as a complete unit.

8.32 **Payment**: Payment shall be made for the complete unit as provided above at the Contract unit Price each and shall constitute full compensation for supplying, installing, connecting testing, commissioning and completion of each type of Public Address Rack for installation of system manager, power amplifier, and accessories of public address system and terminal strips for speaker circuits and microphone, earthing point, multi-socket strip for supply power to the amplifier, Plexi glass door with key locking capabilities acceptably supplied and installed by the Contractor as a complete unit.

8.4 **Public Address System for Mosque**

8.4.1 **Measurement**: Measurement shall be made for the complete job of Public Address system for installation of mixer amplifier, ceiling speaker, microphone socket outlets, each type of microphone, microphone stand including any essential interconnecting equipment and cabling as required with all installation and mounting accessories for satisfactory operation of the entire PA system.

8.4.2 **Payment**: Payment shall be made for the complete job as provided above at the Contract unit Price each and shall constitute full compensation for detail engineering design, supplying, installing, connecting, programming, testing, commissioning and completion of each type of Public Address system for installation of mixer

amplifier, ceiling speaker, microphone socket outlets, each type of microphone, microphone stand including any essential interconnecting equipment and cabling as required with all installation and mounting accessories for satisfactory operation of the entire PA system.

8.5 Wiring of P.A & V.A System- Loudspeaker / Microphone Cable

8.5.1 **Measurement**: Measurement shall be made for the total running feet of wiring of Loudspeaker / Microphone of P.A & V.A System acceptably supplied and installed by the Contractor.

8.5.2 **Payment**: Payment shall be made for the total running feet as provided above at the Contract unit Price each and shall constitute full compensation for supplying, installing, connecting, laying, testing and commissioning of Loudspeaker / Microphone of P.A & V.A System acceptably supplied and installed by the Contractor including all installation accessories.

HOME DEPARTMENT – GOVERNMENT OF SINDH

FORENSIC SCIENCE LABORATORY, KARACHI

ELEVATOR WORKS

SPECIFICATIONS

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SECTION-I

31. ELEVATOR WORKS

SPECIAL PROVISIONS

1.1. SCOPE OF WORK

The scope of work given in relevant sections of equipment shall include but not necessarily be limited to the following:

i. Preparation of all relevant installation/ erection drawings, coordinated shop drawings, obtaining Government and/ or Employer approvals and/ or certificates, fabrication, transportation to site, storage, installation, testing, commissioning, operation and maintenance thereafter for the stipulated period of equipment including training of Employer's staff.

ii. All wiring and controls including necessary material and accessories beyond the power supply point.

iii. Hard wired control connectivity of Elevator controller with building's Fire alarm system.

iv. All other miscellaneous equipment and/ or work required to render the equipment ready for continuous, safe and efficient operation.

v. All relevant civil works as per BOQ/ SOP, Cutting, patching and repairing of damaged civil works required during installation of new equipment. Repairing of damaged civil works and architectural finishes are also included in the scope of work.

vi. Inspection of already constructed related civil works immediately after award of work and confirmation of its suitability for the equipment.

vii. Regular operation (12 hours/ day, 6 days/ week and 300 days/ year) & Maintenance and periodic servicing of equipment during defects liability period (i.e.; 365 days) including greasing, oiling, cleaning etc. of parts as recommended by the manufacturer. Full time operational staff (trained experienced operator cum technician) is required.

viii. Provide all required installation, operation and maintenance manuals, spares lists, drawings and diagrams, inspection test certificates and submission of miscellaneous requisite documentation.

ix. Providing training to Employer's Staff at site regarding operation and maintenance of the equipment.

1.2. CODES AND STANDARDS

All equipment & materials under this works shall be furnished in conformity with latest edition of applicable standards of ANSI, ASME, BS/ EN, AWS, NFPA, ASTM, NEMA, IEE, etc. and applicable Government and Local Codes governing the same. In case of conflict, the strict requirements shown/ specified shall govern. All equipment shall be rated and tested as per relevant standard (latest edition).

Where possible, the same codes and standards shall be used throughout a particular facility. However, the final decision on which codes and standards shall be applied shall remain with the Engineer.

Abbreviation for codes and standards referred to in the contract are as under:

- EN European Norms
- ANSI American National Standard Institute, USA
- ASME American Society of Mechanical Engineers, USA
- AWS American Welding Society
- NFPA National Fire Protection Association
- ASTM American Society for Testing and Materials, USA
- NEMA National Electrical Manufacturer's Association
- IEE Institute of Electrical Engineers, London

1.3. MAKE/ORIGIN OF ELEVATORS

Elevators to be supplied under the Contract, shall be of imported origin and can be provided by any one of the manufacturers mentioned in Schedule-H to Bid “List of Recommended Manufacturers” or approved equivalent subject to meeting the specification requirement (models fully complied and certified with latest EN 81 Standards only).

1.4. QUALITY STANDARD

To guarantee a high-quality standard in the field of designing, fabricating, installing and maintaining the said equipment, only manufacturers with a proven record of similar experience will be considered in Bid Evaluation. To verify the manufacturer’s experience, a reference list with completed projects should, therefore, accompany the Bidding documents.

1.5. PRODUCT HANDLING AND STORAGE

It will be the Contractor's entire responsibility to ensure that all necessary precautions are taken during transportation to avoid damage to any of the equipment.

The Contractor must arrange with the supplier of mechanical equipment, well in advance, that there is sufficient clear and load bearing passage at site to be used for shipping the equipment to the installation place. The Contractor shall also liaise with the equipment supplier with regard to adequate openings and lifting points.

Specific handling or storage requirements will be dealt with in the relevant parts of the specifications, where necessary.

1.6. INSPECTION AND CONTROL

1.6.1. General

The Contractor shall ensure that the manufacturer continuously conducts his own thorough inspections of all equipment during manufacturing, assembling and installation.

The Engineer shall have the power at any time to inspect, examine and test any part of the works, or any materials or plant intended to be used in the works, either on the site or at any factory or workshop where such parts, materials or plant are being constructed, manufactured or from which they are being obtained.

1.6.2. Pre-shipment Inspection

All equipment to be supplied under this Contract shall be subject to inspection and testing by one representative of the Employer and one representative of Engineer along with one Contractor's representative at its point of original manufacture or final shop assembly before its dispatch to site. The Contractor shall make necessary arrangements and provide all the facilities required for the representatives of Employer/ Engineer for conducting such inspection, at Contractor's cost. The cost of travel including overseas travel, arranging of Visas, boarding and lodging of Employer's and Engineer's representatives shall be the responsibility of the Contractor.

In addition, for foreign travel the Contractor shall provide (for two persons) daily allowance in US$ for out of pocket expenses, at $ 200 per day per person. The number of days shall be actual days spent in travel calculated from the dates of travel from and to the hometown of the concerned representative nominated for inspection, but not less than seven (07) days. The US$ in cash shall be provided before start of travel from hometown.

The Contractor shall submit tests procedures for approval of Engineer well in advance to the set date of pre-shipment inspection. The Contractor shall give at least three (03) weeks' notice to the Employer/ Engineer for attending such inspections/ tests.

1.6.3. Inspection at Karachi Port/ Dry Port

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

1.6.4. Inspection at Site Works

All equipment/ materials supplied by the Contractor shall be inspected by the Engineer after delivery of the same at site to assess any damage or short of quantities and any

other requirements of the specifications. The Engineer will issue an inspection certificate if the supplied items of equipment and material are found to be satisfactory.

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

1.6.5. Damages, During Transportation, Storage & Installation

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

1.7. DRAWINGS AND SUBMITTALS

In general, the following submittals are required for the works covered under this Section. However, the final decision with regard to what should be submitted, to what extent and at which time of the Contract period shall remain entirely with the Engineer.

1.7.1. Technical Data Sheets/Technical Submittal

Technical data/ submittal of proposed Elevator shall comprise of the following at the minimum, which shall be submitted along with Bid:

i. Manufacturer's authorization certificate for the proposed brand regarding the subject project.

ii. Manufacturer's technical data & selection sheets clearly depicting all specified safety features as per the Contract Specifications.

iii. Original Catalogues/brochures highlighting the proposed model.

iv. Paragraph wise compliance statement from the equipment Manufacturer/Bidder for Technical Provisions (Volume - II).

v. Outline design drawings, structural drawings and installation shop drawings from the Manufacturer as per existing/proposed shaft sizes.

vi. Full EN81 standards compliance statement for the proposed equipment from the Manufacturer.

vii. List of major essential parts of the equipment specifying country of origin and model duly certified by the Manufacturer.

viii. Warranty statement duly certified by the Manufacturer.

ix. Manufacturer's duly certified list of essential spare parts included with supply of equipment to be used during defects liability period.

x. Catalogue for aesthetic finishes with different options to be submitted.

1.7.2. Design Drawings

The Contractor shall submit Design Drawings along with the Bid for Review/ Acceptance.

The drawings must show in reasonable detail installation and design features such as:

i. Final arrangement of equipment keeping in view the dimensions provided in architectural drawings for civil construction of the Equipment.

ii. Maximum dynamic and static loads imposed on civil structure.

iii. Dimensions and locations of all services, openings in floors and walls, location of embedded parts and location of Employer's furnished electrical connection.

iv. The Contractor shall review the civil construction drawings related to the equipment and identify any major shortcomings/ rectifications essentially required for equipment installation within above stipulated time period. Minor civil rectification and adjustment works are included in Contractor's Scope of Work.

v. Wiring and control logic diagrams.

vi. All other relevant information required by the Engineer.

Approval given by the Engineer is to be understood as an approval to proceed with the works. The approval does not in any way release the Contractor from his Contractual obligation to supply, install and maintain the equipment supplied by him as laid down in the Specifications.

1.7.3. As-Built Drawings

The Contractor will furnish As-Built Drawings separately. Such drawings, diagrams and schedules as well, in the opinion of the Engineer, provide an adequate record of the work "as installed" shall be submitted to the Engineer for approval before the issuance of Taking-Over Certificate.

The drawings shall include particulars of all items of equipment, including wiring diagrams, etc. As-installed drawings shall be submitted to the Engineer at least thirty (30) days before issuance of Taking-Over Certificate.

The size of the drawings shall be minimum A2 size. Every item and dimensions in drawings must be legible.

1.7.4. Installation, Operation and Maintenance Manuals

Two (02) sets of installation manual for the equipment shall be supplied by the Contractor prior to commencement of installation of equipment.

At least thirty (30) days prior to the scheduled date of practical completion, the Contractor shall supply a complete set of operating and maintenance manuals to the Engineer for approval. Once approved, the Contractor shall proceed to prepare and hand to the Engineer three (03) sets of the approved operating and maintenance manuals.

The manuals shall be neatly bound and provided with a suitably captioned hard cover. The contents shall be generally arranged in the following manner unless otherwise specified/ required.

i. Index

ii. General description of the complete facility.

iii. Operating instructions of the complete facility.

iv. Emergency directions of the complete facility.

v. Safety control adjustment and settings of all safety protection equipment.

vi. List of equipment giving manufacturers and agents' name, and name plate data together with all data sheets published by the equipment manufacturer.

vii. Installation, operating and maintenance instructions for each item of equipment (including lubricating charts).

viii. Proforma for Operational log of equipment as per manufacturer recommendation or Engineer's approval.

ix. List of spare parts for each item of equipment as recommended by the manufacturer for at least five (05) years operation.

x. List of essential tools recommended by the manufacturer for Operation and Maintenance.

xi. As-built drawings.

All above submission shall be signed and stamped by the Contractor prior to submission and all submission shall be in English. The approval by the Engineer of the above submission shall not be held to relieve the Contractor of any part of his responsibility to meet all of the requirements of this Contract.

1.8. QUALITY ASSURANCE

The Contractor shall submit with this Bid a written assurance that the materials and workmanship of the equipment installed will be according to recognized international standards and will conform to all contractual requirements of this specification.

1.9. OPERATION AND MAINTENANCE

1.9.1. Operation and Maintenance during Defects Liability Period

The Contractor shall include the operation, maintenance and guarantees of the whole of the Contract Works as laid down in the General and Special Conditions. During this term, the Contractor shall remedy and/ or replace all defective parts or items and correct any omissions certified by the Engineer.

The Contractor will also be held liable for any costs of dismantling or re-erection which may have to be undertaken in order to replace defective parts.

Continuous service operators shall be provided on a routine daily basis for 12 hours/day, 6 days/ week and 300 days/ year for one (01) year.

Services shall be performed by skilled personnel (operator cum technician) under the supervision of experienced supervisors.

The Operation & maintenance shall include operators for continuous operation, provision of spare parts by the Contractor during Defects Liability Period, inspection of all equipment, lubrication of all bearings, the supply of all necessary oil and grease, cotton waste, running adjustments and keeping the installation and equipment in a clean condition unless otherwise specified/ required by the Engineer.

1.9.2. Register of Service, Operation and Maintenance

The Contractor shall provide a register of service, operation and maintenance for the installation. Where such requirements are specially required by any regulation of authorities having relevant jurisdiction over this contract work this shall be complied with strictly.

The Contractor shall also provide and maintain a record of all services, maintenance and repair work carried out in detail. Such record shall be prepared in duplicate and should be in the form of maintenance/ repair sheet with one copy to be retained by the Engineer upon the execution of such services.

All registers and records shall be kept by competent persons in the employment of the Contractor during the period for which he is responsible for maintaining the installation.

1.9.3. Operation and Maintenance Staff during Defects Liability Period

The Contractor shall provide operators in elevators in different shifts to operate the system continuously for 12 hours, 6 days/ week and 300 days/ year during Defects Liability Period of one (01) year. Operating personnel for complete system shall have at least five (05) years' experience in operation and maintenance of similar works. The remaining staff list shall be provided to the Engineer for approval. The staff Nos, skills and experience shall be as per approval of Engineer. The Contractor shall also arrange to provide proper training to Employer staff to operate the system to complete satisfaction of the Employer. All cost incidental to provide operating staff including staff salaries shall be deemed to be included in relevant item of Schedule of Prices. No separate payment shall be made to the Contractor for fulfillment of his obligations under this Clause.

1.10. TOOLS & INSTRUMENTS FOR TESTING, SERVICING, OPERATION AND MAINTENANCE

The Contractor shall supply and deliver to site a complete set of essential tools, test equipment, and other instruments necessary for proper testing, servicing, operation and maintenance of the equipment. Tools shall include special tools and instruments, which are necessary for maintenance repair and overhauls of the equipment. The Contractor will not use these tools for erection purpose, etc.

1.10.1. Spare Parts

All essential spare parts shall be provided by the Contractor and their cost shall be included in the Bid. Also, the recommended spare parts list shall be provided along with prices which shall remain valid for three (03) years beyond Defects Liability Period. List is essential and recommended spare parts is enclosed at the end of the Specifications.

The following shall be included in recommended parts list.

1.10.1.1. Consumables

The Bidder shall provide with the Bid recommended list of consumable spares for a period of one (01) year of operational duties. The list shall contain all consumable items, overhaul kits, fast moving spare e.g., fuses, bulbs, bulb covers, gaskets, oil filters and a full set of at least two spares for all lamps. All items to be separately listed and priced.

1.10.1.2. Normal Spare Parts

The Bidder shall provide with the Bid a recommended list of spares and components, which shall be required to maintain each equipment/part beyond period of one (01) year of operational duties during Defects Liability.

The Bidder shall also confirm in Bid his ability to provide a full range of spare parts and major components for the offered equipment. The Bidder shall provide a guarantee period of at least 25 years for the serviceability of equipment and supply of spare parts and indicate the same in his Bid.

1.11. PAINTING & FINISHES

All equipment, machinery, gears, controls, exposed and unexposed steel work shall be thoroughly cleaned, freed from oil, grease and other foreign substances detrimental to good finishing.

Apply approved primer, undercoats and finishing coats on a properly prepared surface in accordance with the paint manufacturer's recommendation and in accordance with recognized international standards.

The type and shade of paints, particularly of the finishing coat shall be subject to the Employer’s/ Engineer's approval.

Enamel shall also be applied according to the manufacturer's recommendation. Stainless steel finish shall be No.4 finish or equivalent, unless specified otherwise in the specification. If field touch-ups of abraded and damaged surfaces become necessary, the same type of paint used in the factory shall be employed.

1.12. TESTING AND COMMISSIONING

On the completion of the Work substantially in accordance with the Contract, the Contractor shall give the Engineer notice in writing thereof and before making the “Testing and Commissioning" shall give the Engineer and the local authority seven (07)

days' notice in writing of the date on which he will make the said tests of the work in accordance with relevant codes and in the manner prescribed by the Specification.

Unless otherwise agreed, the Contractor shall commence such tests upon the date and shall carry out the same, in the presence of the Engineer or his authorized representative, whose name shall previously have been communicated in writing to the Contractor and the local authority.

If any portion of the works fails under the tests to fulfill the Contract conditions, the Contractor shall inform the Engineer thereof in writing, and tests of the faulty portions shall, if required by the Engineer be repeated within a reasonable time upon the same terms and conditions.

If the "Testing and Commissioning" is not successfully made by the Contractor within one (01) week after the date fixed by the Contractor for the completion for operational use or for the testing of the works, the Engineer may in writing call upon the Contractor under seven days' notice to make such tests, and on the expiry of such notice such tests shall forthwith be made by some other agency appointed by the Engineer at the expense of Contractor.

The Contractor shall supply all necessary utilities, labour, apparatus and instruments necessary for the prescribed tests. The accuracy of the Contractor's instruments shall be demonstrated if required.

The Contractor shall make for payment of all or any fees charged by the local authorities for the above.

The installation will be under the charge of the Contractor during this period, at which time the Contractor shall instruct the Employer's personnel on the maintenance, servicing and trouble shooting of the various plants and system.

Should any failure occur due to, or arising from, faulty materials or workmanship or otherwise, sufficient to prevent the operational use of the installation, the reliability test period of one (01) year shall recommence after the Contractor has remedied the cause of failure to the satisfaction of the Engineer.

1.13. TEST CERTIFICATES AND REPORTS

The Contractor shall provide copies of all test certificates/reports including the following:

i. Test Certificates of critical materials

ii. Factory test reports

iii. Pre-shipment test report

iv. Report of testing & commissioning of equipment

1.14. TRAINING

On completion of all works, but prior to final taking-over, the Contractor shall arrange for free training and instruction to be provided to the Employer's maintenance staff and operators. This training shall cover all aspects of the operation and maintenance of the plant/equipment and shall ensure that the trainee is provided with at least the necessary fundamentals required for the safe and efficient operation of the plant/equipment in question. The instructor(s) must be competent and experienced personnel, well acquainted with the task of lecturing. The schedule of offered training highlighting the details of syllabus indicating number of hours for training and field instruction subject to be taught and no. of Employer's staff strength to be trained shall be enclosed with each Bid so as to allow for an evaluation by the Engineer.

1.15. MANUFACTURER WARRANTEE

The Contractor shall submit two (02) copies of written warrantee from the manufacturer under his cover warrantee that the material and workmanship of the equipment installed is according to recognized international standards and conform to all contractual requirements of this specification that he will make good without extra cost any defects not due to ordinary wear and tear or improper use, which may develop within two (02) years from date of the installation being handed over to the Employer.

During the last month of the warrantee period, the Contractor shall demonstrate to the Engineer that all equipment and accessories are operating to the required specifications.

The manufacturer warrantee period shall be two (02) years after final commissioning.

In case if equipment remains out of order for more than ten (10) days or more, warrantee/ maintenance period will be extended accordingly.

1.16. MEASUREMENT AND PAYMENT

No measurement and payment shall be made for the works involved within the scope of this section of specifications unless otherwise specifically stated in the schedule of prices or herein. The cost thereof shall be deemed to have been included in the quoted unit rate price of other items of the schedule of prices.

SECTION-II

TECHNICAL PROVISIONS

2.1 GENERAL

This section shall cover Elevators where indicated on the drawings and specified herein. Any conflicts between the requirements in this specification and the codes, drawings, standards and specifications referred to herein shall be brought immediately to the attention of the Engineer for resolution. The Bidder shall submit technical data sheets, outline drawing and printed technical literature to fully elaborate offered equipment. The Bidder is advised to visit the site to check the available elevator shaft**,** pit depth and machine room etc. to ensure that offered equipment will suit to existing conditions.

2.2 SCOPE OF WORK

Following elevator works are required for Sindh Forensic Science Laboratory Building, Karachi;

i. Supply of One (01) No. Brand new 5000 kg Freight Elevator, fully-EN certified heavy-duty MR (Machine Room) Type with Simplex control serving Ground floor + Upper Five (05) floors. Design to operate 12 hours/ day, 6 days/ week and 300 days/ year.

ii. All associated civil, architectural and electrical works necessarily required for installation of elevator in the shaft.

iii. Making good any damage done to the civil works including supply and installation of matching paint, floor tiles, granite / marble wall finish etc., whichever is applicable as per site conditions and/ or as directed by Engineer.

iv. Supply and installation of exhaust fan propeller type of size 12” Dia (SP 0.2 inch of WG) are required for each Machine Room/shaft respectively including complete electrical work.

v. Supply and installation of Electric Distribution Board and related electrical works at elevator control panel on last floor and cables for elevator power supply and other electrical accessories required for proper installation of the elevator.

vi. Supply and installation of split air conditioner with Hydrophilic blue/black fin having cooling capacity of 2 tons of refrigeration (TR) heavy duty (10 hours operation), high ambient (0~40ºC compatible) for Machine rooms/Shaft (for MRL) of elevator.

The scope of work shall cover design, supply, installation, testing, commissioning, operations and maintenance of entire elevator equipment including hoisting machinery, sheaves and girders, controller, car, ropes, counterweights, supports, brackets, guide rails, car doors, landing doors, door operator, switches, control, safety devices, signals, governor, safety gears, buffers, pit screens, well trimming girders, trap door, hard wired control connectivity of Elevator controller with building’s Fire alarm system and such related accessories complete in all respects as specified herein. The Contractor shall also provide all the labor, erection equipment, (i.e., winches, scaffolding etc.), erection tools, appurtenances, embedded parts and materials, etc. necessary to supply, install,

test and commission the elevator all in perfect operating conditions in accordance with these specifications and drawings. The Contractor shall submit design drawings/ shop drawings within two weeks after award of work for approval of Engineer. The drawings must show final arrangement of equipment, dynamic & static loads imposed on the building, openings, location of embedded parts etc. wiring and control logic diagrams.

The Contractor shall be responsible to make good any damage done to the civil works for erection or other purposes without cost to the Employer.

The Contractor shall also provide and install, from designated electrical power supply point, all required cabling, distribution boards and accessories without cost to the Employer.

The Contractor shall maintain the works during Defects Liability Period. In addition to routine periodic maintenance, the Contractor shall execute all such work of repair, rectification, parts replacement and making good defects occurring during this period. Design of equipment to be supplied by the Contractor shall also be the responsibility of the Contractor and/ or his suppliers.

The Contractor shall also provide training to the staff of Employer regarding operation and maintenance of the equipment.

Prior to completion date, the Contractor shall submit Three (03) copies of Operating and Maintenance Manuals to the Employer/ Engineer.

2.3 DESIGN REQUIREMENTS

2.3.1 Elevator System General Requirements

i. Elevators shall be designed specifically for the operation; loading and environmental conditions encountered in specialized forensic building and shall have a minimum design life of 25 years.

ii. The final assembly of all components shall not pose hazardous conditions to the public or maintenance personnel. Surface irregularities, sharp edges, or protrusions in public or maintenance areas shall not be permitted.

iii. Provide convenient and safe equipment access for inspection, cleaning, maintenance, repair, and replacement.

iv. All gaps and running openings within regulatory tolerances shall be properly closed by the use of appropriate sealant or another approved means installed in accordance with the manufacturer’s instructions.

v. For parts and equipment subject to wear and requiring periodic replacement, the Contractor shall furnish key and seat, nut, screws, or other removable and replaceable type mechanical fasteners. Such replacements shall not diminish original structural integrity. Use of rivets or similar type fasteners requiring physical deformation during field positioning will not be permitted.

vi. The elevator equipment shall be quiet and smooth running and shall not exceed the following maximum noise output levels during all phases of operation:

- 70 dBA measured in the elevator car
- 70 dBA measured at the elevator hoist way entrances

vii. Fire Protection: Contractor shall provide non-combustible materials for components including Halogen-free cables.

2.3.2 Seismic Criteria

i. Installation and equipment designed for static and for seismic conditions shall be provided in accordance with regulatory requirements.

ii. Provide hardware necessary to protect motors, drives, and door operators

iii. Seismic design shall be based on the assumption that structures and equipment will be subjected to a maximum horizontal ground acceleration of 0.7g (70 percent of gravity).

2.3.3 Power

The main elevator power shall be 400 V, three phase, 50 Hertz.

2.3.4 Elevator Controller

i. The controller for Elevators shall be a field programmable microprocessor based, collective selective control, automatic operation with open loop, variable voltage, and variable frequency control.

ii. Elevator operation shall be by means of Push Buttons in the car, numbered to correspond to landings served, by push buttons Call at terminal landings, and by UP and DOWN Push buttons at intermediate landings.

iii. All options or parameters shall be field programmable without the need for external devices. Programmable settings shall be stored in non-volatile memory.

2.3.5 Elevator Door and Hoist way Door Operation

2.3.5.1 Hoist way doors and car doors shall

i. Open automatically and simultaneously when the car arrives at the destination landing.

ii. Be equipped for readily and independently adjustable door hold open times when car stops for a car or hall call. Main floor door hold times shall be adjustable independently of other floors.

iii. Close after hold open time interval has elapsed and no obstruction has been detected, or when the car is called or dispatched to another landing, or when either the car door close button or a car call is pushed.

2.3.5.2 Activation of the door close button in the car shall cancel door timer and close the doors provided there is no obstruction

2.3.5.3 All closing times shall be adjustable from 5 seconds to 30 seconds without exceeding closing force specified herein.

2.4 MATERIALS & WORKMANSHIP

2.4.1 Materials

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

All materials including electrical wirings shall be weather proof.

2.4.2 Workmanship

All work shall be performed and completed in a thorough workmanlike manner and shall follow the best modern practice in the manufacture of high-grade machinery, notwithstanding any omissions from the Bid Documents. All work shall be performed by mechanics skilled in their various trades. All parts shall be made accurately to American Standard or other approved gage, where possible, so as to facilitate replacement and repairs. All bolts, nuts, screws, rivets, threads, pipes, gages and gears shall conform to applicable American or other approved standards.

2.4.3 Structural Metal Work (NOT USED)

2.5 PRODUCT DESCRIPTION

2.5.1 General

Elevators shall be installed by the Contractor in the shaft at location shown on the drawing. The dimensions of respective elevator wells and pits are also shown on the drawings.

The Contractor is recommended to visit the site to examine the existing structures and details to verify and confirm suitability of the existing structure for the installation of the equipment.

Any changes in the above planned elevators shaft and pit floor structure or other design details due to particular equipment requirement shall be submitted by the Contractor to the Employer/Engineer for approval within fifteen (15) days from the date of Award of the Contract. All such approved amendments shall be made by the Contractor without any additional cost to the Employer. Similarly, the elevator contractor must coordinate the installation with the other trades.

The elevator contractor shall also provide opening in Elevator well for suitable ventilation and for escape of gases and smoke in case of fire.

The control cabinet/ panel of MR type elevator shall be located in machine room and control cabinet/ panel of MRL elevator shall be located at the last serving floor. The dimensions/ location shall be given by the elevator Manufacturer.

The location of drive machinery and control cabinet shall suit the elevator orientation to allow easy access and sufficient space for maintenance work and to provide a good-looking architectural outlook.

The Contractor shall acoustically insulate the elevator shaft and shall appropriately isolate the equipment to prevent disturbances in the surroundings area due to operating machinery.

i. Sound reducing materials to isolate motor set from civil structure, balance rotating parts to eliminate vibrations and flexible electrical conduits shall be provided. The operation of elevator car and doors shall be completely free from all abnormal jerks, vibrations and sound. The maximum sound level within the car must be within comfortable limits defined in relevant standards/codes.

ii. The elevator Contractor must schedule his installation work in accordance with civil construction schedule.

The characteristic details of the elevator to be supplied under this contract are listed under para 2.6. The construction and functional details are given hereunder:

2.5.2 Civil Construction

2.5.2.1 Elevator Well

The elevator shall be installed in the completed elevator wells of dimensions as available on site.

The top of the well shall be enclosed and watertight.

The Contractor shall be responsible to carry out minor correction for the purpose of installation of guides in perfect plumb and other equipment to ensure perfect installation and operation of the elevators without any cost to the Employer.

2.5.2.2 Pit Access Ladder

A rugged steel ladder for easy access to the pit shall be provided by the elevator Contractor. The pit access ladder shall be attached with a safety switch inside the pit.

2.5.2.3 Pit Screen

A suitable rigid screen shall be provided and fixed by the Elevator Contractor at the bottom of the elevator well where the counterweight comes down to its buffers and between elevators if required. The screen shall have a minimum height of 7 ft. as per code requirements.

2.5.3 Elevator Car

2.5.3.1 Car Frame & Platform

The car frame, consisting of upper yoke with cross yoke side braces and bottom frame shall be made of welded or bolted steel channel sections, sufficiently rigid to withstand the operation of the safety-gear without permanent deformation of the car frame. The

elevator car, platform, door operating mechanism, safety doors, etc. shall be mounted on car frame.

The deflection of the members carrying the platform shall not exceed 1/1000 of their span under static conditions with the contract load evenly distributed over the platform.

Roller guides, mounted on car frame, shall have individual suspension to cushion jolts and minimize noise and vibration.

The platform shall be of fabricated frame of formed and structural steel shapes gusseted and rigidly welded, with provision for a floor covering as specified with the car body work. Rubber pads of sufficient size shall be provided between the car frame and the platform to provide sound and vibration isolation. The underside of the platform will be covered with sheet steel to provide adequate fire resistance.

An aluminum sill grooved to suit door spuds shall be fitted to the platform together with a toe-guard.

The car bodywork shall be carried on the platform with the top fixing to the car frame being suitably isolated.

All auxiliary equipment shall be mounted and supported from the car frame.

2.5.3.2 Car Body Work

The car bodywork shall be of steel construction with provision for interchangeability of décor finishes and ceiling designs. The roof shall be constructed to withstand the weight of two men without deformation.

One side of the car shall have vision panel. Vision Panels shall be installed in such a way that vision panels on car and hoist way shall be aligned.

The car top shall have provision for emergency communication and roof trap door with micro-switch. A3 pin socket outlet shall be fitted on top of the Elevator car, besides two outdoor protected type lights one each at the bottom and top of the car operated through an MCB.

2.5.3.3 Finish

The car enclosure and floor shall be as mentioned in Technical Data Clause 2.6 or approved by the Client/Employer.

Ceiling shall be of removable type with modular LED light fittings.

Handrails on two side walls shall be provided with satin finish standard stainless steel hollow section. Fixing brackets shall also be in stainless steel.

The design and finish of car interior together with suspended ceiling, light fittings, floor covering and other fittings shall be to the Engineer’s approval. The Contractor shall offer various options of car finish with his bid.

2.5.3.4 Telephone

A telephone compartment shall be provided in each car in the front return panel above the car operating buttons. The compartment shall be provided with hinged door flush with the panel. The entire compartment and door shall be of stainless steel.

The Contractor shall also provide a telephone set in the compartment which shall be connected to the central control center. The intercom connection work with the Central Control Center included in elevator contractor scope of work.

2.5.3.5 Recessed Motion Sensing Unit

The motion sensor unit shall be recessed into the ceiling. Provide a mounting bracket flush to the ceiling for the motion detector unit. The motion detector shall be located and adjusted so that movement of the doors does not generate a false occupancy. Provide the 120 Vac-power supply to the power pack unit of the motion detector.

Programmed Operation: If after a programmable length of time, an elevator car call has not been activated and the sensor detects elevator car occupancy, the car shall be programmable to proceed with either one of two courses of action. The choice of action shall be selectable by the motion detector switch in the service panel on the Car Operating Panel. The logic and circuitry of this alarm shall be incorporated into the controller circuit. Any auxiliary relay contact required to accomplish this feature shall be provided. This circuit shall be depicted in the schematic diagram of the controller. All occupancies, regardless of operation, shall be reported to the Communication Room.

Automatic Car Call Mode: Upon occupancy detection, the elevator shall automatically generate a car call to the opposite floor if a car call is not activated within an adjustable time of 5 to 30 seconds.

Nuisance Occupancy Mode: If occupancy is detected without a car call for an adjustable time of 5 to 30 seconds, then the doors shall reopen and remain open with audible alarm until a car call or hall call is generated or the car is vacated.

2.5.3.6 Camera

A 360° camera shall be mounted in the ceiling corner on the front wall opposite of the side of the Car Operating Panel. The camera shall be adjusted to observe patrons inside the Car. The camera shall be housed in a vandal resistant enclosure. The display of the camera shall be available in the control room. All necessary hardware till control room and software shall be provided by the Contractor. The connection work with the central control room included in elevator contractor scope of work.

2.5.4 Doors

2.5.4.1 Landing Doors

Each landing shall be provided with center/side opening doors as shown on drawings. The doors, frames and architrave shall be made of stainless steel in satin finish. The

door panels shall have a fire resistance rating of at least one hour. The panels shall be interconnected by maintenance - free self-tensioning synchronizing wire rope.

Each landing shall be equipped with a toe-guard apron at the hoist way entrance side. The toe-guard apron shall be of sheet steel not less than 16 gauge thick, and shall extend not less than 50mm beyond the entrance jamb at each side. Toe-guard apron shall be approximately 2 feet deep, adequately fastened and braced; the lower edge turned inward.

The frames shall be of 14 SWG (min.) and panel's fascia, toe-guards, dust and hanger covers shall be of 16 SWG. All other features not covered above shall be similar to that specified under Car Doors.

Each landing entrance shall be equipped with an approved type factory tested interlock as required by the code. The interlock shall be designed to prevent moving of the car away from the landing until the doors are locked in the closed position as defined by code and shall prevent opening of the doors at any landing from the corridor side unless the car is at rest at that landing or is in the leveling zone and stopping at that landing.

Landing door unlocking device as specified by the ANSI A17.l or B.S. 5655: part 1 Code shall be provided to permit authorized persons to gain access to hoist way when Elevator car is away from the landing.

Each Landing door or door panel shall be furnished with sheave type two-point suspension hangers and tracks complete in all respects. The sheaves shall have polyurethane tires with ball bearings sealed and lubricated for life. Hangers shall be provided with an adjustable slide to take the up-thrust of the doors. Tracks shall be of cold drawn steel shapes with smooth surface and shaped to conform to the hanger sheaves. Tracks shall be removable for replacement.

2.5.4.2 Car Doors

The car doors shall be center/side-opening type as shown on drawings. The door-gear shall operate by a fractional kilowatt AC motor with VF drive. The door gear shall be built-in unit with the car door top track support, mounted on the car entrance column extensions.

A retractable car door coupling shall be provided to connect the car and landing doors to eliminate any backlash and ensure complete door synchronization.

The car doors, frame and front shall be of stainless steel (brush finish) with panel construction and other features such as fire rating, etc. similar to the Landing Doors.

The door panels shall be suspended from sheave hangers with polyurethane tires and sheaves running on a polished steel track, and guided at the bottom by non-metallic shoes sliding in an extruded aluminum threshold groove.

If the car is stationary at floor level with the doors closed, it shall be possible to open the car doors from inside the car by pushing the car door in the opening direction. To open the doors from the landings, the triangular key must be used.

2.5.4.3 Door Safety Devices

2.5.4.3.1 Full Width Light Curtain

The car doors shall be fitted with light barrier system extending from 25mm above floor level up to a height of 1600 mm, operating between car and landing doors. The barrier system shall comprise of a transmitter and a receiver strip containing several pairs of transmitters & receivers generating a large number of invisible light rays. In case if any one of these rays is interrupted, the control unit immediately reverses the door motion. The light curtain shall recalibrate itself at regular interval to update its scanning cycle.

In addition to above, the car doors shall be provided with an additional safety such as Door closing force limiting device or photoelectric beam etc. to maintain operational safety in case of failure of the main light barrier system.

2.5.4.3.2 Door Open Timing Feature

The door operation shall also have door open timing feature operation in conjunction with light rays to provide adjustable, reduced, hold open time once rays are broken and re-established. In the event rays are broken beyond an adjustable time, a buzzer shall sound and doors to close at reduced speed.

2.5.4.4 Door Operator

A variable frequency controlled variable speed door operating unit capable of opening and closing car and landing doors simultaneously shall be mounted on the car frame independent of the car bodywork. The mechanism shall be designed to achieve smooth acceleration and retardation of doors without the use of dashpots. All pivot and bearing points shall be of steel and nylon or bronze bushed pins, ball or roller bearings suitably lubricated shall be fitted.

The driving mechanism shall be designed such that:

The closing force applied to the doors shall meet the requirements of B.S. 5655: Part I.

The car doors can be opened by hand in the event of a mains failure.

The motion of the doors will be reversed if they meet an obstruction. An AC motor with VF drive to provide variable speed shall be provided to obtain the performance required by the control system.

Mechanical Control Station, carrying controls and equipment as specified in B.S. 5655 shall be fitted on the top of the operator.

2.5.5 Hoisting Equipment

2.5.5.1 General

The elevator shall be MR (Machine Room) type. The complete drive machinery and convertor shall be installed in machine rooms for MR type or as indicated in drawings. The Contractor shall provide exact location of Drive Machinery and other equipment so

as to allow sufficient access and space for maintenance work within fifteen (15) days after award of the contract.

Anchor bolts, templates, inserts, signal boxes, and sleeves for installation shall be furnished by the Contractor. Additional structural members such as steel angle, steel beam supports for governors, motors, controller, and rope guards shall also be supplied by the Contractor.

Each hoisting machine and corresponding controller shall be numbered with 100mm high numerals giving elevator numbers.

Sound reducing buffers of elastic material shall be provided under the base of the hoisting machines to isolate sound and vibrations from the building structure. The rotating parts shall be dynamically balanced to eliminate vibration.

2.5.5.2 Hoisting Machines

2.5.5.2.1 Gearless Traction Type

The hoisting machine shall be of the permanent magnet gearless drive with motor, brake and other integral parts mounted as one assembly on steel bed plates so that proper alignment of these parts is maintained under all conditions.

Means shall be provided on all elevator machines to enable the elevator cars to be raised or lowered in an emergency by manual operation. The direction of winding corresponding to the raising and lowering of the elevator car shall be clearly indicated.

Manual operation shall be by a smooth-rimmed detachable, spoke less wheel fitted to the shaft.

2.5.5.2.2 Brakes

The brake shall be spring actuated, electrically released and of adequate proportions for the duty involved and fitted with two self-aligning shoes actuated by compression springs.

The brake shall be instantly and automatically applied in the event of interruption of the power supply.

The brake shall be capable of bringing the car to rest smoothly, under maximum conditions of load and speed, and capable of sustaining static load of 150% of the contract load.

2.5.5.2.3 Motor

The variable voltage variable frequency (VVVF), motor specially designed to meet all elevator duty requirements shall have a duty cycle rating of a minimum of 180 starts per hour. The motor speed shall have controls to allow smooth transition between acceleration and deceleration phase. The motor shall be capable of stable operation at

all speeds up to the stated maximum and no abrupt speed change shall be permitted. It shall have a drip proof enclosure and may be force ventilated.

The drive motor shall be rated to provide sufficient power to accelerate the elevator to full speed in the shortest period while maintaining passenger comfort.

The power system shall incorporate solid state equipment controlling the speed of the elevator motor. Smooth performance with steeples acceleration and deceleration is to be provided with a leveling accuracy of ± 0.25" and the final stop at floor level is to be achieved dynamically after which the machine brake shall be applied to hold the elevator car stationary.

2.5.6 Hoist-way Equipment

2.5.6.1 Suspension Ropes/Belts

Suspension ropes of high-grade steel specially designed for elevator duty shall be provided in conformity with the requirements of B.S. 329. The material of the rope shall conform to B.S. 2763. It shall be free from loose wires, distorted strands or other irregularities. All rope terminals shall comply with B.S. 461. Independent adjustment shall be provided for each rope. All suspension ropes material and strength shall comply the requirements of latest EN 81-20 & EN 81-50 standards.

The length of each rope shall be so adjusted that it loses traction with sheave when the counterweight touches its buffers.

An automatic device shall be provided for equalizing the tensions of suspension ropes at least at one of their ends.

Suspension belts as per International Standards may be provided as an alternative to suspension ropes. However, Contractor will ensure trouble/ jerk free operation in suspension belt due to power break down problem.

All necessary equipment/ material shall be provided for trouble free operation. Manufacturer certificate on letter head for the same is required with use of suspension belts.

2.5.6.2 Guides, Fixings and Inserts

The guides shall consist of high quality 'T' section steel of adequate strength and dimensions suitable for travel, car weight, speed and capacity of elevator. Guiding surfaces shall be accurately machined. The joints shall be spigotted and joined by machined steel finish plates.

Guides shall be of sufficient length to prevent any of the car or counterweight shoes from running off the guides.

All guides are to be securely fixed to the walls of the elevator well by steel brackets bolted to metal inserts or by other approved means. Rag bolts shall not be permitted.

All metal inserts, fixings, guide rails, anchor bolts etc. shall be provided by the elevator Contractor.

Guides shall be so jointed and fixed to their brackets that they do not deflect by more than 3mm under normal operation.

Guides and their fixing shall withstand the application of the safety-gear without permanent deformation when stopping a fully laden car or the counterweight.

2.5.6.3 Guide Shoes

The sliding guide shoe shall comprise three slide elements, wherein each slide elements forms a respective. The arrangement shall be suitable for an oil-free mode of operation. Three fastening grooves each for preferably (with respect to the direction of insertion or longitudinal direction) mechanically positive reception of a respective slide element shall be provided in the support element. Support element shall comprise at least one bearing pin formed, preferably monolithically, at the support element. The guide shoe housing shall have a cut-out, which is complementary with the bearing pin.

The sliding guide shoe shall comprise a preferably separate protective element for protecting the slide surfaces from contaminations. The protective element in that case be positioned at the holding element on an inner side facing at least one slide element. In completely assembled position the protective element shall bear against the slide element or slide elements shall seal protects these.

2.5.6.4 Counterweight

A counterweight equal in weight to the car plus 40% to 50% of the specified load shall be provided to each elevator. Structural Steel frame shall support requisite number of cast iron weights. It shall be fitted with guide shoes and suspension arrangements and accessories suitable for specified elevator capacity.

2.5.6.5 Safety Gear and Governor

A friction type progressive safety gear actuated by centrifugal over speed governor shall be securely bolted to the car frame under the car platform.

The governor wire rope operating the safety gear mechanism shall not be less than 8mm diameter.

The tension weight fitted with an electrical safety device shall be provided to cause the hoist motor to stop should the governor rope break or slacken.

The governor shall be fitted with a direct driven unit to relay to the control system both the speed and position of the elevator in shaft.

The governor shall be equipped with two electrical switches, preset to operate progressively in case of over speeding to reduce the elevator speed in the first stage and if the elevator speed is not brought under control, operate to cut of power supply to the hoist machine and apply brakes.

If the car continues to travel downwards at excessive over speed, the mechanical trip shall operate causing the governor jaws to grip the rope to bring the safety gear mechanism into operation causing the jaws to grip the guide rails equally through self-aligning friction shoes thus bringing the car to rest gradually and smoothly. The governor and safety gear shall be released by raising the car.

In case of elevator pit have another floor under it or access to public there must be second Safety Governor with safety gears attached with counter weight frame and operation will be same as stated above for Safety Governor attached with the Car.

The governor and safety gear shall be adjusted to operate as specified by B.S. 5655.

2.5.6.6 Buffers

Oil buffers of spring-return type or as mentioned in EN standards shall be supplied and installed in pit under car and counterweight for each Elevator. The minimum total stroke of the buffer shall be based on the retardation of 32 feet/sec^2 based on 115% contract speed. The maximum rate of retardation of the oil buffers based on 115% contract speed shall be 80.5 feet/sec^2 excluding any transient declarations having duration not exceeding 0.04 sec.

The buffers shall be mounted on continuous channels securely anchored to the pit floor and fastened to the guide rails. The channels, anchors and any additional supports required for buffers shall be provided by the Contractor.

The buffers shall be fitted with means of ascertaining the correct amount of oil in the buffers.

Each buffer shall be permanently and legibly marked to indicate the type and quantity of oil to be used within the buffer.

The buffers shall be self-setting type fitted with safety device to ensure its return to their normal position after operation.

2.5.6.7 Final Limit Switches

The elevators shall be equipped with an automatic device arranged to bring the car to a stop at the terminal landings independent of the regular operating devices in the car. Final limit switches should stop the car and prevent normal operation should it travel beyond the normal stopping device.

Separate control devices for normal stopping and final limit switches shall conform to the requirements of BS 5655: Part I.

2.5.7 Controller & Control System

2.5.7.1 Controller

The controller shall be floor mounted, upright type enclosed in enamel finish steel cabinet with either hinged doors at the front and removable panels at back or hinged door both at front and back.

The control system shall be microprocessor based and fitted with all safety devices to protect equipment and motors from damage in the event of overload or other malfunction. Protection against phase reversal shall provide as per code.

The driving unit control module, comprising of power and command module, shall control drive performance parameters. The controller unit shall control acceleration & deceleration, speed and the jerk rates during change in acceleration or deceleration to provide stepless speed variation for maximum passenger comfort. The jerk rates shall be individually adjustable to user's satisfaction. Upon receiving signal to perform journey, the command module shall evolve optimum speed profile for each journey and trigger power module for AC/DC and DC/AC conversion for necessary drive current and voltage to obtain desired motor torque.

The controller shall control car motion on feedback from motor-mounted tachometer and operate the brakes of hoisting motor through the signals received from micro switches and load weighing devices.

The controller shall be arranged to cut off the power supply, apply the brake and bring the car to rest upon failure of operation of any of the electrical safety devices.

2.5.7.2 Control System

2.5.7.2.1 General

The design of control system shall be based on functionally arranged section modules featuring high degree of efficiency, economy of operation, adaptability to changing operating conditions, safety and reliability in operation through maintenance free electronic circuitry.

The control equipment shall be microprocessor based electronic solid state. The total system shall be designed to operate in normal machine room ambience and incorporate full protection against noise and electrical interference generated within the power section, controller and switchgear. The system design shall allow the control algorithm to be reprogrammed by software changes.

The Controller shall be state-of-art microprocessor-based controller capable of high-speed data transmission and analysis for optimization of traffic control.

All modules shall be tested at the manufacturer's works prior to installation. System component shall be subjected to environmental endurance, thermal shocks and salt spray in test chambers.

2.5.7.2.2 Monitoring of Elevator through IBMS:

The Contractor shall supply controller along with communication interface, based on BACnet over IP protocol for real time monitoring and error reporting to the Integrated Building Management System (IBMS).

The built-in controller/communication interface shall be supplied by the elevator's Manufacturer for Remote Monitoring and Integration with Integrated Building Management System (IBMS) of the Building. Any Software, if required, for integrating Elevators with IBMS shall also be provided by Elevator Manufacturer.

The following is a list of parameters which shall be monitored and recorded for each Elevator. The list is indicative only and shall be finalized according to Client/Project requirements:

i. Operations Status of Elevator (Running, Out of Service, or Maintenance mode).

ii. Elevator Running Up/Down

iii. Elevator Error/Fault Detail

iv. Emergency Stop

v. Main Power Supply Failure

vi. Elevator logs with Down Time Calculations

2.5.7.2.3 Supervisory Operational Mode

The operational mode of the Elevator shall be automatic control as specified in para 2.6. with special operation features, viz emergency operation and fireman switch.

The control system shall be provided with a parking feature, which returns the car to the main floor when there are no calls in the system.

The elevator shall be provided with individual landing station and operated from interconnected landing buttons including two operating devices in the car. Single touch buttons shall be mounted at each terminal landing.

On touching car or landing buttons, (other than those for landing at which car is standing) shall start the car provided interlock circuits are established and causes car to start traveling in the direction of registered call. Car shall stop at the designated landings for which calls are registered with stops made in order in which landings are reached, irrespective of sequence in which calls are registered, provided call for a given landing is registered sufficiently in advance of arrival of car at that landing to permit stop to be made.

If there are no car calls and car start up in response to outside landing calls, car shall proceed first to the highest down call and then reverses to collect other down calls. Up landing calls shall be collected similarly when car starts down in response to such calls. If car stops for a landing call and a car call is registered within a predetermined interval

after stop for a landing corresponding to direction car was travelling, car shall proceed in the same direction regardless of other landing calls registered.

If DOWN landing buttons are touched while car is travelling up, car shall not stop at these landings, but calls remain registered. After highest car and landing calls have been answered and door interlock circuit is established, car shall reverse automatically and respond to down car and landing calls. When travelling down, car shall not respond to up landing calls, but calls shall remain registered and answered on next up trip. No double door operation shall be permitted.

2.5.7.2.4 Load weighing

Means shall be provided for weighing passenger load. Control system shall be designed to provide dispatching in advance of normal intervals and to provide landing call by-pass when the car is filled to approximately 80% of full capacity load.

Settings shall be individually adjustable. A buzzer shall be provided to indicate overload in elevator.

2.5.7.2.5 Door Operation

Doors shall open automatically when a car arrives at a terminal to permit egress of passengers. When another car is at the terminal and is loading for departure or upon expiration of a timed interval, the doors shall close until car is designated for loading. In the event a passenger has entered the elevator, the doors shall reopen upon registration of call on the car button or by pressing the door open button. If no other car is at the terminal, an arriving car shall have its doors open until the car is dispatched or expiration of a timed interval with no demand.

2.5.7.2.6 Automatic leveling

An automatic 2-way leveling device shall be provided, designed to govern the leveling of the car to within 6mm above or below the landing sill. The leveling operation shall avoid over-travel, under-travel, of the car and maintain the leveling accuracy regardless of the load in the car, direction of travel, rope slippage or stretch in ropes.

2.5.7.2.7 Independent Operation

Controls shall be provided for operation of the elevator from car buttons only. A key operated switch shall be provided in each car.

2.5.7.2.8 Emergency Features

i. Emergency operation: The Elevator shall be equipped with control system to operate and recall the cars in fire or other emergency conditions and to allow the elevator to run on emergency power supply.

ii. Hard wired control connectivity of Elevator controller with building's Fire alarm system and operate automatically when received signal through Building Fire alarm system.

iii. The operation of elevator on emergency service shall be as follows:

- The Elevator shall be operable only by a person in the car.
- Elevator shall not respond to Elevator corridor calls.
- The Elevator will stop at the next level.

iv. The opening of power operated doors shall be controlled only by buttons or switches. If the switch or button is released prior to the doors reaching the fully open position, the doors shall automatically re-close. Open doors shall be closed by either the registration of a car call or by "door close" switch or button.

v. Elevators shall be removed from emergency service by moving the emergency service key-operated switch in the car to the 'off' position with the car at the main floor.

vi. Emergency Lighting and Emergency alarm unit: An emergency light shall be included for each elevator car. An automatic change over switch shall be provided in the controller so that upon normal supply failure Emergency power supply shall be available for the light fixture, exhaust fan, and alarm unit.

vii. The Contractor shall supply a suitable button in the car control wired to a terminal box fixed in the elevator shaft near the bottom floor served. A suitable alarm bell shall be provided and fixed including all necessary wiring connecting up to the terminal box.

viii. The power for the emergency lighting, exhaust fan and alarm bell shall be from the same emergency supply consisting of rechargeable nickel cadmium battery unit with trickle charger and 10 years minimum life expectancy.

ix. Emergency power transfer: In the event of normal power failure, adequate power will be supplied through Employer furnished stand-by generator to run the Elevator.

x. Operation under Standby Power: A control signal from the generator shall be provided to the elevator controller or elevator group to place the elevator or group of elevators in emergency power mode, which will cause the elevators to return to the designated floor and remain there with the doors open. If there are a group of elevators, power shall be provided to only one elevator at a time and automatically switch to the remaining elevators until all elevators have returned to the designated floor with the doors open.

xi. Intercom: The Contractor shall install for each elevator, an intercom facility with control room or at location designated by Employer for 24 hours communication. All necessary cabling and conduiting is included in contractor’s scope of works.

xii. Earthquake control: In the event of an earthquake, the elevator facility shall be provided with a seismic detector which will bring all cars to stop at the next floor and open the doors.

xiii. Emergency Rescue Device (ERD): In the event of a power break down, the elevator shall be provided with ERD which will bring all cars to stop at the next floor till the power is resumed.

xiv. Manual Brake Release Lever: In case of a power break down and fault in ERD, the elevator shall also be provided with a manual brake release lever to manually evacuate the passengers. And it shall be fixed inside the control panel to be used only by the designated person.

2.5.8 Signals & Fixtures

Contractor shall provide fixtures and signals as follows, test complete system, correct any deficiencies in wiring and function and make complete system fully functional. Location and arrangement of fixtures and signs shall comply with the ADA and other code requirements.

2.5.8.1 Integrated Hall Indicator

An integrated hall indicator consisting of digital TFT/LED type car position indicator (revealing floor position of car) and illuminated arrows indicating the arrival and departing direction, as determined by the control system shall be installed above each individual elevator and at each landing. A two-tone electronic gong shall also be provided for audible announcement of the arrival of the elevator car.

The digital car position indicator shall be of TFT/LED type with character height of 35-40mm.

The integrated hall indicator shall be of horizontal configuration. The stainless-steel face plate, min. 2mm thick, of satin finish containing the digital car position indicator and direction arrows. The hall indicator shall operate on 24 V D.C. supply.

2.5.8.2 Landing Call Station

Landing call station fitted with push button Panels shall be installed at each landing. It shall be designed for mounting on the landing door frame or on adjacent side wall, subject to Engineers' approval.

The push button Call Panels shall be of flush type, constructed of stainless-steel panel suitable for long arduous duty. The translucent surround of the push button Call Panels shall illuminate to indicate acceptance of call signal.

The push button Call Panels of each landing station shall be inter-linked such that with the pressing of call button of any elevator, call buttons of elevators in the same direction shall light up and record the call.

2.5.8.3 Car Station/Car Operating Panel (COP)

The car station shall be integrated/aligned with the front return of the car and constructed from stainless-steel push-button panels with TFT/LED display.

The hinged full height front panel of the car station shall carry the controls and indicators. The panel shall be fitted with a secret release, which can only be opened from the back of the trough. When the hinged panel is opened an isolate/ normal switch shall be available. The car operating panel shall be recessed in the wall of lift cabin and edges of car operating panel shall be flushed with the wall of lift cabin.

The car-operating panel shall contain at least the following controls with push button Call Panels:

i. Alarm button

ii. One floor button for each floor served

iii. Open door button/hold on button

iv. Key operated car independent service switch

v. Key operated fan switch

vi. Digital TFT/LED type car position indicator and direction arrows

vii. Intercom

viii. Speaker for position announcement

All push button Panels shall be set flush with the panel surface for maximum resistance against abuse. When operated, a LED illuminated halo shall highlight the screen thereby informing that the call has been registered. The push button Panels shall be made of stainless steel with the appropriate floor marking.

The digital car position indicator and direction arrows of TFT/LED type shall be positioned above the floor marking.

Separate Car Operating Panel for wheel chairs user shall be provided in the car lift with all necessary features as per EN81-70 standards.

2.5.9 Power Supply & Electrical Installations

2.5.9.1 General

The power supply at load break switch will be available in the Elevator machine room. All further wiring, controls and providing proper distribution boards, along with necessary material and accessories beyond the power supply points shall be supplied and installed by the Contractor. The electrical installation and appliances shall comply with relevant prevailing International Standards.

2.5.9.2 Wiring Installation

All wiring shall be carried out in accordance with the IEE regulation, NEC standard and B.S.S. wherever applicable.

All cables shall be PVC insulated, and if required PVC sheathed also, single or multicore having tinned copper conductors. Cables for different voltage circuits which are run together must have the insulation rating, suitable for the highest voltage present. Wherever cables are subjected to high temperature such as termination to car light, it shall be protected by suitable heat resistant sleeve. At all terminations, cable ends shall have numbered ferrule to match with the mark on respective component and control drawings. All wiring shall be continuous between terminations.

Travelling cables between the elevators well and elevator car terminal boxes shall be suspended by looping over reels or by suitable clamps. The connections in the terminal boxes shall be marked for identification purposes.

Travelling flexible cables shall be fire resistant and shall comply with B.S.

2.5.9.3 Trunking and Conduits

All wiring from machine room to motor controls at each floor and to other circuits shall either be run in 16 SWG galvanized steel conduit or trunking, the selection and route of which shall depend on the number of cables and ease of installation and maintenance. If trunking is installed it shall have removable covers, and the trunking finished in dark grey enamel as per B.S. 381C. Fixing arrangements of conduit of trunking shall be vibration proof suitable for the existing conditions. All connections from trunking or conduits to motors or other equipment subjected to vibration shall be with flexible galvanized steel conduit. All trunking and conduit shall be continuous through out the length to ensure good earth continuity.

2.5.9.4 Earthing

Earthing of all equipment and metal work which can be subjected to dangerous voltage under normal operating and fault conditions shall be earthed in accordance with NEC Standard. One PVC insulated earth conductor of suitable size having yellow colour with green tracer shall be run along the trunking or conduit as main earth. All branch circuits in conduit or trunking and other metal work shall have branch earthing cable connected to main earth. All length of trunking shall also be bonded to main earth.

2.5.9.5 Testing

Testing of electrical installations shall be carried out to the satisfaction of the Engineer in accordance with standard practice and recognized international standards/codes.

2.5.10 Fire Protection

All precautions will be taken to eliminate the potential sources of fire and smoke sources and prevent flame propagation. In particular:

i. Halogen-free cables will be used,

ii. Oil, grease and dust will be collected,

iii. No plastic materials shall be used in these systems.

Each elevator will be equipped with a fire and smoke detection unit and linked to the fire detection system.

Hard wired control connectivity of Elevator controller with building’s Fire alarm system and operate automatically when received signal through Building Fire alarm system.

2.5.11 Local Materials

2.5.11.1 Pit Screen

A suitable rigid steel screen shall be provided and fixed by the Elevator Contractor at the bottom of the elevator well where the counter-weight comes down on its buffers and between elevators. The screen shall have a minimum height of 7 ft. as per code requirements.

2.5.11.2 Separator Beams & Well Trimming Girders

Properly designed separator beams and trimming girders shall be supplied and installed at proper location in Elevator well by the elevator contractor to suit fixing requirement of offered elevator. The separator beams and trimming girders installed in elevator shall be of at least 200mm rolled I-beams of prime quality structural steel (ASTM A-36 or equivalent).

2.5.11.3 Trap Door

The Contractor shall provide and install the trap doors of rugged construction in the machine rooms at location shown on relevant drawing to enable access of the hoisting machinery into the machine rooms. The trap door shall be strong enough to temporarily withstand/support heavy machinery. It shall be installed flush with the finished floor when closed and be lockable only from inside the machine room.

The Contractor shall include the above items in his bid price for the elevators.

2.6 TECHNICAL DATA

2.6.1 Freight Elevator Schedule-Quantity One (01) No.

Sr. No.	Description	Minimum Requirement
01	Type	Machine Room Type (MR) heavy duty VVVF Freight Elevator (Through/Double entrance type) fully complied with EN 81-20, EN 81-50 and EN81-70 standards.
02	Capacity	5000 Kg
03	Elevator Speed	0.50~1.0 m/sec
04	Travel Height	As per BOQ/SOP
05	No of Stops/Openings	Ground floor + 05 upper floors (06 stops/07 openings)
06	Internal Car Sizes (w x d) x h	(2600mm x 3400mm) x 2500 mm as shown on drawing
07	Machine Type	VVVF AC gearless drive
08	Car & Counterweight Guide Shoes	Sliding guide shoes
09	Drive Location	In Machine Room above Shaft
10	Control System	Simplex control

11	Architraves	Full width of Stainless-Steel satin finish at all floors as approved by the Client/Employer at all floors.
12	Elevator Shaft Size (w x d)	As per layout drawing attached
13	Pit Depth	As per layout drawing attached
14	Head Room	As per layout drawing attached
15	Buffers	Oil buffers of spring return type (Energy Dissipation type) or as recommended by EN 81 Standards
16	Door Size	2500mm x 2400mm (Through/Double entrance type)
17	Door Operation & Type	VVVF control, Power operated, 4-Panel Centre opening stainless steel panel construction and fire rating of 2 hr.
18	Indicators	- Hall LED Type digital car position (floor) indicator on each landing with direction arrows. - Car Operating Panel (COP) LED Type digital car position (floor) indicator inside car with direction arrows. - Two tone electronic gong announcing arrival of car.
19	Landing Call Station	Push buttons type or as approved by the engineer with call acceptance illuminated indications.
20	Car Operating Panel (COP) (02 Nos. each elevator - One (01) for wheelchair users as per EN 81-70)	- Integral with the front return of the car as per requirement of lifts and constructed of Stainless Steel and recessed/flushed with wall at both sides. Including handicapped passenger features or as approved by the engineer. - It shall include alarm buttons, floor call buttons, door open/hold button, key-operated attendant switch, fan switch, intercom, all buttons shall be of push button type or as approved by the engineer (connection with building safety/security system is included in Contractor's scope).
21	Car Design	- Stainless Steel Hairline Finish at all floors as approved by the client/employer. - Front return and car door of stainless steel (hairline finish) construction or as approved by the client/employer. - Full width half height mirror on rear wall or as per manufacturer design. - Ceiling removable type full extended poly carbonate diffuser with modular light fittings as approved by engineer - Ventilation Blower (Pre-Installed) - Handrails on two side - Stainless steel Floor or as per manufacturers and EN 81 recommendations. - Inter Telecommunication system - Emergency exit - Load measuring device with overload buzzer and inter-lock till overload is removed. - LED Lighting
22	Door Safety Devices	- Full height Light curtain protection (2D) - Door opening timing feature

23	Special Features	- Attendant control - Emergency operation and fireman switch. - Emergency lighting & alarm unit. - Earthquake control system - Voice guidance system - Connected with building control - Suitability for 0~40°C ambient temperature - Phase reversal failure indication & interlock - Security Cameras for surveillance (Connection with building safety/security is included in Contractor's scope) - ERD Device (Emergency Rescue Device with battery backup) - Manual Brake Release Lever - Halogen free cables
24	Interior Finish	Superior/Highest/Executive quality as per approval of engineer on submitted samples.
25	Minimum Functions	- Direct Leveling - Optimum travel curve - Re-running automatically when elevator is re-powered - Car location adjusted automatically - Load compensating - Travel Counter - Over/Under voltage protection - Phase trip protection - Over current protection - Over heat protection - Encoder trip protection - Contact adhered protection - Bi-directional over speed protection - Reversal protection - Travel over time protection - Final terminal protection - Over load protection - Anti-door lock bridge - Automatic by-pass hall call while full load - Level for self-helping - Travel to next floor when open door trip - Emergency illumination in car - Emergency alarm - Automatic car fan - Automatic car lighting - Fire return feedback - Settable landing number - Automatic parking, parking floor - Car calls cancelable - Parking key switch, landing - Fire return (Phase I), Main landing - Hoist way lighting - Car door button - Unintended Car Movement Protection (UCMP)
26	Trips/hour	240 minimum
27	Power Supply	- 3 Phase / 400V / 50 Hz. - 1Phase/230V/50 Hz. (for lighting)

28	Monitoring/Integration with BMS/ Building Controls	Communication module/Controller based on BACNet over IP for each Elevator to be provided for integration with Building Management system (BMS)/Building Controls.
29	Ambient Condition for Motor/control safeties for shafts etc.	0°C to 40°C
30	Inspection & Test Language	English
31	Elevator Mode	Two Mode: - Normal Mode: From the car or from the landing. - Maintenance Mode: Low speed (inspection running).
32	Design Life	25 Years

NOTES:

i. Bidder is advised to visit the site to check as built dimensions of elevator shafts, overhead and pit and confirm in his bid that offered elevators will suit to as built dimensions.

ii. All leaflets properly signed/stamped in original to be submitted with the bids for the equipment including drive, controls, car design, doors & architrave, indicators landing and car station, safety devices etc. being offered.

iii. Any variation in the technical aspects of the offered model by the Bidder, against the data provided along with Bid, due to manufacturer's standards will be subject to Engineer's approval.

2.7 INSTALLATION

2.7.1 General

The installation of elevator equipment including its electrical installations shall comply with applicable standards, manufacturers' instructions and recommendations. Electrical work required during installation shall comply with NFPA 70 or approved equivalent.

The scope of installation and civil works shall include the following:

i. Providing and/or cutting all necessary holes, chases and openings and making good after installation of equipment.

ii. Supplying and fixing all supports, beams, ladders etc. necessary for the installation of the machinery, guide brackets, doors, buffers etc.

iii. Furnishing all necessary cement and/or concrete for 'grouting-in' brackets, bolts, etc.

iv. Providing and fixing suitable scaffolding and protection of work in progress.

2.7.2 Welded Construction

Welded construction shall be provided for installation of Elevators wherever bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, or replacement of worn parts. Welding

workmanship and qualification of welding operators shall comply with American Welding Society (AWS) standards or approved equivalent.

2.7.3 Sound Isolation

Rotating and vibrating Elevator equipment and components shall be mounted on vibration - absorption mounts designed to effectively prevent the transmission of vibrations of the structure, and thereby eliminate the sources of structure - borne noise.

2.7.4 Lubrication

Operating parts of the system including ropes, guides, etc., shall be lubricated as per manufacturer's recommendation.

2.7.5 Alignment

Proper co-ordination of installation of hoist way entrances with the installation of elevators' guide rails shall be done for accurate alignment of entrances. Wherever possible the final adjustment of sills and doors shall be delayed until the car is operable in the shaft. The clearance shall be reduced to minimum, safe, workable dimensions at each landing.

2.7.6 Sills

Sill unit shall be set at each floor landing accurately aligned, slightly above structural floor, to suit level of scheduled floor finish.

2.7.7 Painting, Retouching & Re-finishing

After completion of installation and testing to the satisfaction of the Engineer-in-Charge, the Contractor shall carryout all finishing, retouching and refinishing operation on the entire equipment accessories and installation matching the original finish in an approved way. All auxiliary works carried out by the Contractor as the finished installation shall also be painted in the approved standard after applying anticorrosive base.

2.8 TESTING AND INSPECTION REQUIREMENTS

The Contractor shall submit separate list of shop tests, to be conducted prior to shipment and field tests after installation prior to commissioning.

The Contractor shall arrange pre-shipment inspection of the equipment as per requirements given in Bidding Documents.

Testing after installation shall be carried out for each elevator before it is put into normal service in accordance with B.S. 5655 Part 10 and appropriate certificate shall be completed. The tests shall include but be not limited to the following:

i. Functioning of all system and devices

ii. Operational test of all safeties

iii. Protection against false signals

iv. Earth fault test on cable/controller & switch gears

v. Insulation resistance test for cables

A thorough inspection of all equipment shall also be undertaken at this stage and appropriate certificate shall be completed.

Elevator shall be periodically re-examined during defect liability period and at the end of guarantee/defect liability period appropriate certificate shall be completed to assess operational performance.

All equipment and personnel required to complete testing and inspection shall be provided by the Contractor. All erection work and tests shall be performed by the Contractor's erectors who shall be suitably qualified and experienced persons to the satisfaction of the Engineer.

LIST OF ESSENTIAL SPARE PARTS

A. Elevators

1.	Guide Shoes	2	Nos (Each Type)
2.	PCB Cards	1	Nos (Each Type)
3.	Lubrication Oil	1	Nos (Each Type)
4.	Landing Operating Panels	2	Nos (Each Type)
5.	Landing Indicators	1	Nos (Each Type)
6.	Emergency Lights	1	Nos (Each Type)

PART I: ESSENTIAL SPARE PARTS

Following is a list of essential spare parts to be provided with the supply of equipment. Furthermore, all spare parts required during Defects Liability Period of one (01) year shall be provided by the Contractor and their cost shall be included in the Bid.

Sr.No.	Spare Parts	Qty	Unit
1	2	3	4
A.	**Elevator Spare Parts to Be Supplied (Not to be Used in DLP)**		
1.	Guide Shoes	2	Nos (Each Type)
2.	PCB Cards	1	Nos (Each Type)
3.	Lubrication Oil	1	Nos (Each Type)
4.	Landing Operating Panels	2	Nos (Each Type)
5.	Landing Indicators	1	Nos (Each Type)
6.	Emergency Lights	1	Nos (Each Type)
B.	**Manufacturers Recommended Spare Parts for Defect Liability Period**	**LOT**	**Nos. (Each Type)**

PART-II RECOMMENDED SPARE PARTS

I. LOCAL

Sr. No.	Description	For Equipment (Give Equip. Code)	Unit	Qty.	Unit Rate (Rs.)	Amount (Rs.)
1	2	3	4	5	6	7

Total: _____

II. IMPORTED

Sr. No.	Description	For Equipment (Give Equip. Code)	Unit	Qty.	Currency	Unit Rate	Amount (Rs.)
1	2	3	4	5	6A	6B	7

Total: _____

SECTION 8112

32. UNINTERRUPTIBLE POWER SUPPLY SYSTEMS

1.0 SCOPE

The present specification indicates the characteristics required for the supply of uninterruptible power systems.

The product supplied must be compatible with the specification requirements. Any departure from the specification must be indicated in the bid phase.

2.0 APPLICABLE STANDARDS & CODES

The following Standards are referred to in this Part:

IEC 60647 Low Voltage Switchgear and Control gear
IEC 60948 Low Voltage Control gear

2.1 Submissions

Submit in accordance with General Specification for electrical works

2.1.1 **Shop Drawings**

a) Submit dimensional drawings of the main switchboard, including sections and elevations, showing the following:

i) Sizes and positions of components
ii) Positions and method of fixing cable and boxes
iii) Location of terminal boards
iv) Other pertinent data

2.1.2 **Project Data**

a) Submit

i) Full specifications of the enclosure and the components of the equipment with relevant sheets of manufacturer's catalogues

ii) Confirmation that the equipment complies with the relevant specifications

3.0 MATERIAL

3.1 DESCRIPTION OF THE REQUIRED SYSTEM

The UPS system shall be comprise of single rectifier, battery charger and inverter modules:

a) The UPS system shall be designed in such a way that any spare part, printed circuit boards, sub-assembly or component, can be replaced without any adjustment

b) It shall supply clean, uninterrupted power to the critical loads and meet the specifications

c) Transformers shall be manufactured using vacuum pressure impregnated insulation.

The system required is an uninterruptible power system (UPS) with rating mentioned in BOQ with On Line double conversion technology: the load is always powered by the inverter, which supplies a sinusoidal voltage that is filtered and stabilized in voltage, form and frequency. Moreover, the input and output filters significantly increase the immunity of the load against mains interference and lightning.

CHARACTERISTICS

- The system has to provide a power supply that is filtered, stabilized and reliable (On Line double conversion technology in accordance with standard EN50091-3) with filters for the suppression of atmospheric noise.
- The on line technology guarantees maximum protection for the connected loads. A double conversion stage is also required to filter and stabilize the input voltage, by regenerating it and removing mains interference (overvoltages, frequency and voltage fluctuations)
- The UPS must provide the following features:
- Total microprocessor control
- Distributed parallel configuration
- Automatic battery test
- Ups can be connected in parallel and redundant up to 8 units even different power rating
- Protection against battery deep discharge
- Automatic shutdown function when load is absent
- LCD and LEDs display

- Low consumption:
- The UPS must provide various operating modes to reduce consumption. The user must be able to select from the following modes:
  a. **"on line**" operation (in compliance with standard EN50091): to guarantee maximum protection for the load
  b. **"line interactive"** operation (in compliance with standard EN50091): to guarantee minimum consumption
  c. **"automatic line interactive"** operation: the UPS automatically selects line interactive operation, after checking the quality of the mains power supply and running load and mains interference diagnostics
  d. **"back-up"** operation: for the supply of power to emergency lighting
     - Automatic restart when mains power returns
     - Frequency auto-sensing
     - Manual by-pass
     - Monitoring and shut down software included:
     - Network management through TCP/IP protocol:

The system must be provided with the software to guarantee the efficient and intuitive management of the UPS, displaying by means of bar graphs the most important information such as input voltage, applied load, battery capacity, etc.

- External manual by-Pass:

It must be possible to connect the UPS to an external manual by-pass system. Manual bypass switch system of full UPS shall be integrated into the UPS so that load can be transferred to mains supply WITHOUT break for maintenance of UPS. Procedure for transfer to maintenance bypass and back to UPS shall be controlled by the bypass menu of the UPS, thus eliminating possibility of causing disturbance of load by operator who is unaware of correct procedures (it must also be possible to read on the UPS display the signals on the status of the external by-pass).

- Interfacing

Connectors for remote signals and controls

The UPS must provide the following connectors:

connectors for EPO, emergency remote shutdown control, female DB15 (input/output contacts for remote signalling); male DB9 (RS232-1); female

DB9 (RS232-2 for modem connection);

slot for SNMP card

The contractor shall assess the electrical load capacity of the UPS taking into account derating for non-linear and worst case ambient temperature conditions.

The UPS cabinet shall be designed such that all components are removable from the front and cable entry by floor mounted gland plates.

3.2 **Rectifier/Charger**

The rectifier/charger shall be solid-state type with fully controlled 6-pulse thyristor bridge and anti-harmonic chokes. It shall have 10 sec walk-in ramp for input current, adjustable battery current and voltage. It shall recharge a fully discharge battery in 24 hours. A boost charge facility shall be provided. A normally open contact rated at 220 Vac, 2A, close on boost charge, shall be provided for remote monitoring. Input voltage ratings are as follows:

a) Mains 1 (input to rectifier/charger)
Voltage : 400 volts AC ◊ 10% / 220 volts AC ◊ 10%
Wiring : 3-phase, 4 wire + Earth / 1-phase, 2 wire + Earth
Frequency : 50 Hz

b) Mains 2 (input to static switch)
Voltage : 400 volts AC ◊ 15% / 220 volts AC ◊ 15%
Wiring : 3-Phase, 4 wire + Earth / 1-Phase, 2 wire + Earth
Frequency : 50 Hz

c) Synchronization Range: ◊ 0.75 Hz

3.3 **Battery**

Unless otherwise specified in the Project Documentation, the battery shall be of sealed lead acid maintenance free type and sized for the pre-selected time with the UPS operating at rated load. The battery set shall be installed in similar cabinet finish as the UPS unit.

The battery system shall be sized to maintain full load for a period of 8~10 minutes.

3.4 **Inverter**

The inverter shall be of transistorized PWM type, for the specified UPS rated power at 0.8 p.f. Output rating shall be as follows:

Wiring	:	3-phase, 4 wire and earth / 1-phase, 2 wire and earth
Voltage	:	400/220 volts (ϕ 1%), 50 Hz
Transient voltage regulation	:	Voltage transients shall not exceed ϕ 5% for a 100% load step change and the return to steady state value shall be in less than 20 milliseconds.
Harmonic distortion	:	Less than 4% THD
Efficiency	: :	For 100% load 92% For 50% load 91%
Audible noise	:	< 65 dBA @ 1.5m

Output synchronized in amplitude, phase & frequency to mains 2 when mains 2 is within tolerance limits. Phase difference between inverter output and mains 2 held below 3 (electrical) in such condition so that the maximum gap while transfer to UPS from Mains 2 and vice versa occurs shall be less than 167 micro seconds.

3.5 **Overload Capabilities**

a) Inverter shall sustain 125% overload for at least 10 minutes and 150% overloads for 1 minute. After delay, if overload persists, the load shall be transferred to bypass supply without break if Main voltage is within tolerance limits. The UPS shall check the load and if the load is below overload threshold, inverter shall restart automatically and load shall be transferred back to inverter. Facility to inhibit automatic re-transfer shall be provided.

3.6 **Monitoring and Control**

Monitors

a) The following status information shall be monitored by indicating lights on the front panels of the UPS:

i) rectifier/charger on
ii) load on inverter
iii) load on Mains 2 bypass
iv) alarm

v) inverter shutdown imminent
vi) boost charge

b) an audible alarm shall warn the user of faults or operating problems. The system shall be equipped with an alarm off button. Metering values displayed on an alpha-numeric display.

c) The following measurements shall be available:

i) inverter output voltage (L-L)
ii) Inverter output frequency
iii) inverter output currents
iv) voltage across battery terminals
v) battery current (charge) input voltages
vi) mains 1 rectifier/charger) input voltages (L-L)
vii) rectifier/charger input currents.

3.7 **Remote Control and Monitoring**

On request, the supplier must be able to guarantee 24 hour remote supervision of the equipment. The products provided must therefore be able to dialogue via modem and to communicate with the authorized support centres that will be able to interrogate the system periodically and verify the present and past operating parameters, and send a report to the user, in fully automatic mode.

The UPS must be able to call the support centres to signal alarms or faults automatically so that the support centre may intervene immediately. Remote transmission shall be possible for all controls, monitors and measurement indication on the UPS unit.

3.8 **Protective Devices, Controls and Monitors**

The UPS shall be built on modular basis.

The UPS shall include protection against input over voltage, load short – circuits, external or internal over-temperature, vibration and Impacts during transport, etc. The UPS shall stop automatically if the DC voltage drops below a pre-set minimum value.

Signalling on the operating status of the UPS is to be provided by means of a liquid crystal display (LCD) with contrast control and having two(min) rows of atleast 30 characters.

Controls shall be micro processor based and the following main controls shall be possible:

- four luminous report signals: power supply and by-pass lines input
  inverter output
  by-pass line output
  battery input
- rectifier/charger on/off
- inverter on/off
- forced shutdown
- forced transfer upon forced shutdown of inverter when the bypass power supply is outside tolerances
- self-test

- an acoustic alarm device.

4.0 TESTING

The Ups manufacturer shall provide proof of a stringent Quality Assurance Program. In particular the main equipment manufacturing stages sanctioned by appropriate tests such as: incoming components inspection, discrete sub-assembly tests and complete functional checks on the final product. Equipment shall undergo on-load burn-in laving the factory. Final inspection and calibration operations shall be documented in a report drawn up by the supplier's Quality Inspection department.

TECHNICAL DATA

UPS Rating	KVA
INPUT	
Input phases	
Nominal voltage	V
Maximum input tolerance for non-intervention of battery	V
Nominal frequency	Hz
Power factor	
BY-PASS	
Maximum acceptable tolerance for mains switching	%
Configuration of voltage tolerance (from control panel)	%
Maximum frequency tolerance accepted for switching	%
Configuration of configurable frequency tolerance (from control panel)	%
Switching time in Line Interactive mode (by-pass/inverter and vice versa)	ms
Protection against mains back feed	
OVERLOADS ON BY-PASS (xIn)	
1s	
10ms	
Efficiency	%
BATTERY	
Type of battery	
Intervention time (mains failure)	
Nominal power supplied	KW
Compensation of battery voltage with temperature	mV/°C per element
OUTPUT	
Number of phases	
Nominal voltage	V
Field of regulation of the phase/neutral voltage (from control panel)	V
Wave form	
Frequency	Hz
Operation as frequency converter	

Operation as back-up unit (load powered only if mains absent)
Current peak factor (as per standard EN50091-3)

Nominal power (VA)	KVA
Nominal power (W)	KW
Static variation	%
Dynamic variation (with load impact from 0 to 100%)	%
Output frequency variation with mains absent	%
Output frequency variation with mains present	%
Output frequency variation (from mimic panel)	%
Voltage distortion (linear load)	%
Voltage distortion (non-linear load)	%

OVERLOAD TIMES (from inverter)

100%< Load <110%	hrs
110%< Load <125%	min
125%< Load <150%	min
Short circuit current (t<0.5 sec.)	%
Short circuit current (phase/neutral)	In
Short circuit current (phase/phase)	/
Inverter efficiency	%

VARIOUS

AC/AC efficiency (double conversion mode)	%
AC/AC efficiency (Line interactive mode)	98%
Maximum permanent operating temperature	°C
Humidity	%

PROTECTIONS

Noise	dB(A)

DIMENSIONS

Mechanical characteristics	Shielded metal cabinet with applied plastic front
Level of protection	IP
Cables input	Front, from the bottom
Cooling	Forced ventilation, with speed variable according to load

HOME DEPARTMENT
GOVERNMENT OF SINDH

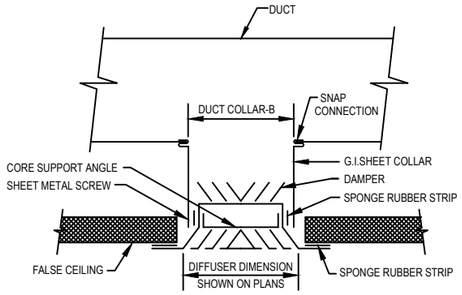
ESTABLISHMENT OF SINDH
FORENSIC SCIENCE LABORATORY KARACHI
MAIN BUILDING

HEATING VENTILATION AND AIR CONDITIONING (HVAC) WORKS

HVAC DRAWINGS
4th & 5th FLOORS
DUCTING WORKS

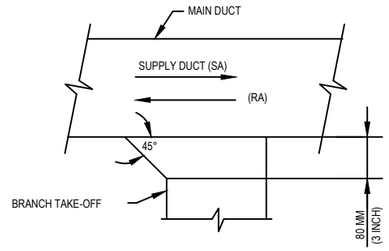
APRIL, 2025

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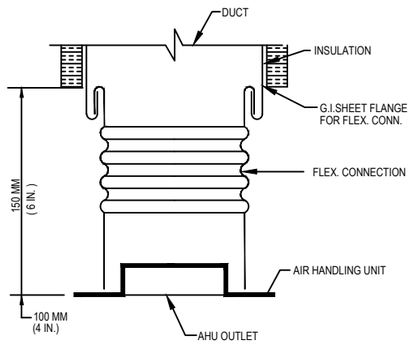


NOTES:
1. DIFFUSER SHOULD NOT BE SCREWED TO OR SUPPORTED FROM CEILING FRAME OR PANELS.
2. DETAIL SHOWN IS ONLY INDICATIVE, ACTUAL DETAIL TO BE PROVIDED BY CONTRACTOR AFTER COORDINATING WITH FALSE CEILING DETAILS.

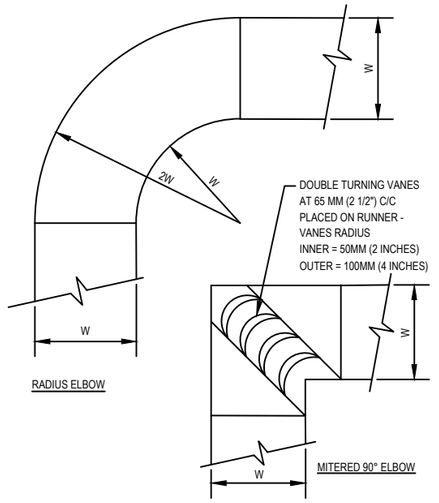
DIFFUSER INSTALLATION



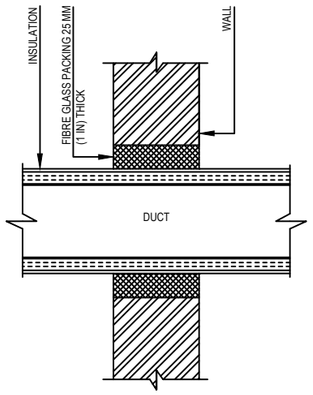
BRANCH DUCT TAKE-OFF



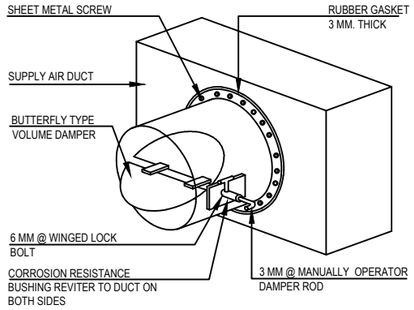
FLEXIBLE DUCT CONNECTION



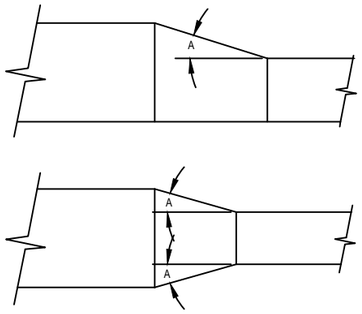
DUCT ELBOW FABRICATION



DUCT THROUGH WALL SUPPLY AND RETURN

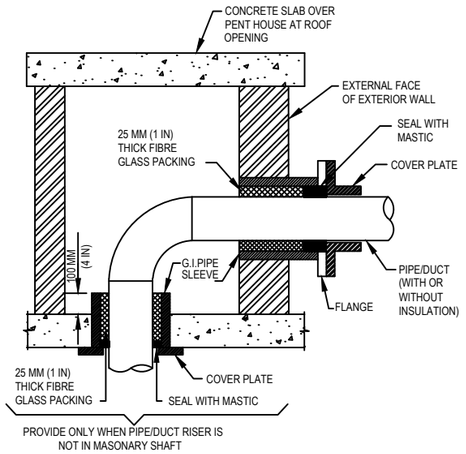


DAMPER DETAIL

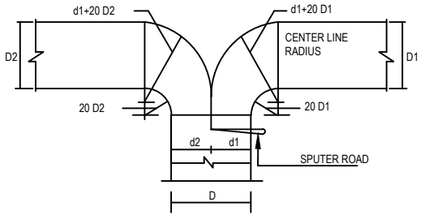


TAPER ANGLE A:
1. FOR ENLARGING AREA = 20° MAX. (RETURN DUCTS)
2. FOR REDUCING AREA = 30° MAX. (SUPPLY DUCTS)

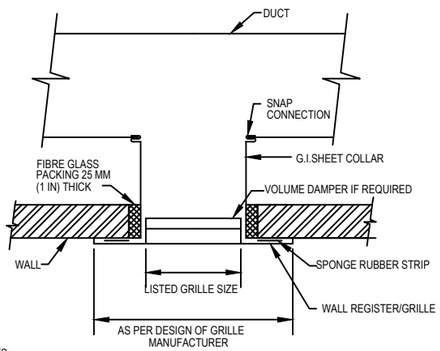
DUCT TRANSITION FABRICATION



PIPE/DUCT THRU EXTERIOR WALL AND ROOF

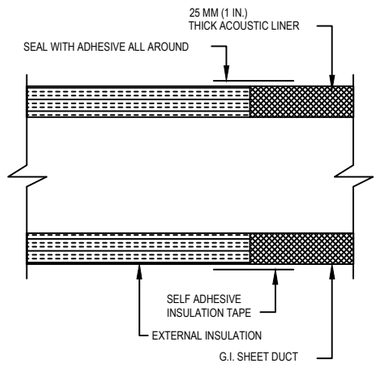


TYPICAL TAKE OFF

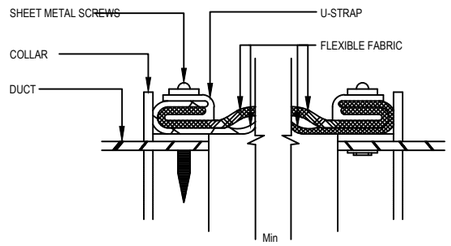


NOTES:
1. REGISTER SHOULD NOT BE SCREWED TO OR SUPPORTED FROM CEILING FRAME OR PANELS.
2. DETAIL SHOWN IS ONLY INDICATIVE, ACTUAL DETAIL TO BE PROVIDED BY CONTRACTOR AFTER COORDINATING WITH FALSE CEILING DETAILS.

WALL REGISTER/GRILLE INSTALLATION



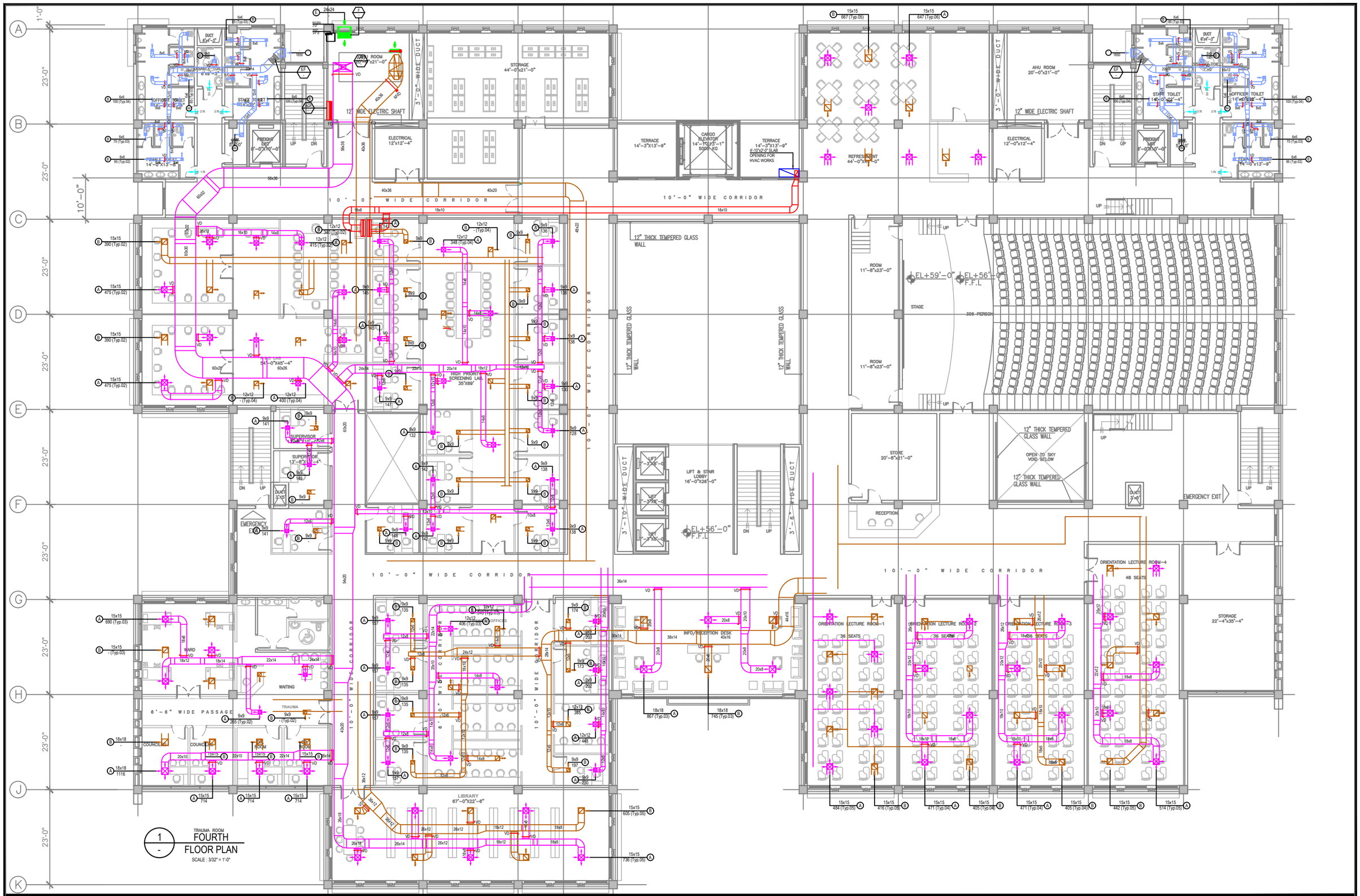
JOINT AT ACOUSTIC LINER AND EXTERIOR INSULATION



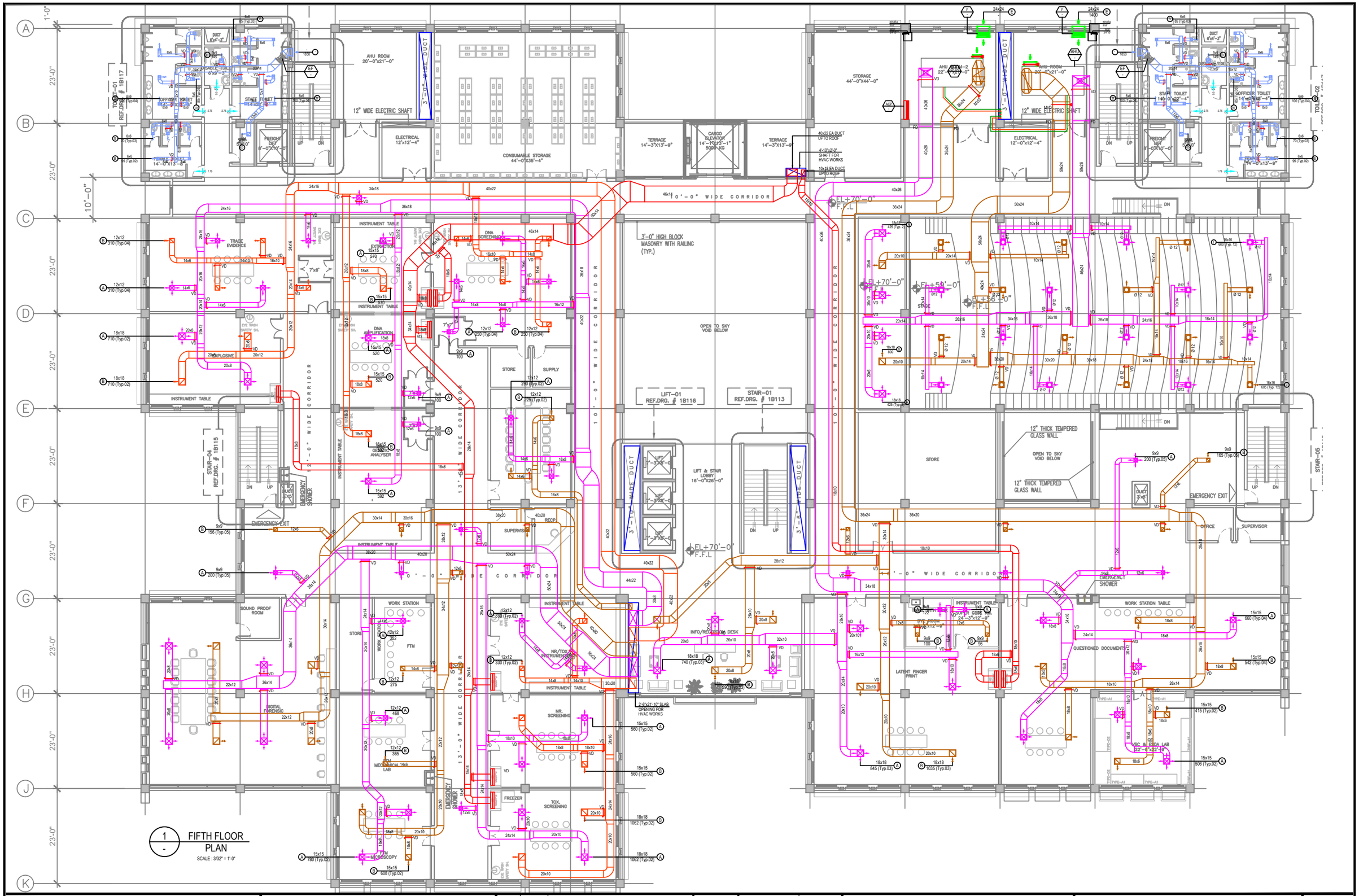
FLEXIBLE CONNECTION

NOTES:
1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR LEGENDS, LIST OF DRAWINGS AND GENERAL NOTES REFER DRAWING NO. 4268/04/TD/1K01.

CLIENT	HOME DEPARTMENT, GOVERNMENT OF SINDH				
CONSULTANT	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. ARCHITECTURE & PLANNING DIVISION KARACHI. 4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34				
04				DRAWN	M.TOQEER
03				SUBMITTED	
02				RECOMMENDED	
01				CHD./VER.	
REV.	DATE	DESCRIPTION	APPROVED	APPROVED	
PROJECT	ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI				
MAIN BUILDING HVAC - STANDARD DETAILS					
DATE	APRIL, 2025	DRAWING No.	-	REV.	0
SCALE					



CLIENT	HOME DEPARTMENT, GOVERNMENT OF SINDH	CONSULTANT	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. ARCHITECTURE & PLANNING DIVISION KARACHI. 4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34	04		DRAWN	M.TOQEER
				03		SUBMITTED	
				02		RECOMMENDED	
				01		CHD./VER.	
				REV.	DATE / DESCRIPTION / APPROVED	APPROVED	
PROJECT	ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI	MAIN BUILDING HVAC - FOURTH FLOOR PLAN				SCALE	
		DATE	APRIL, 2025	DRAWING No.	-	REV.	0



1 / - FIFTH FLOOR PLAN

SCALE : 3/32" = 1'-0"

CLIENT	CONSULTANT				
HOME DEPARTMENT, GOVERNMENT OF SINDH	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.	04		DRAWN	M.TOQEER
	ARCHITECTURE & PLANNING DIVISION KARACHI.	03		SUBMITTED	
	4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34	02		RECOMMENDED	
		01		CHD./VER.	
		REV.	DATE / DESCRIPTION / APPROVED	APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
HVAC - FIFTH FLOOR PLAN

SCALE

DATE: APRIL, 2025

DRAWING No.: -

REV.: 0

HOME DEPARTMENT
GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH
FORENSIC SCIENCE LABORATORY KARACHI

- **MAIN BUILDING**

FIRE FIGHTING WORKS

TENDER DRAWINGS

APRIL, 2025

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED
13th Floor, N.I.C. Building, Abbasi Shaheed Road, Off. Shahrah-e-Faisal, Karachi
PABX:+92-21-99090000 Fax : +92-21-35651994, 99225366
E-mail : karachi@nespak.com.pk, Website: www.nespak.com.pk

LIST OF DRAWINGS

SR. NO.	DRAWING NO.	TITLE
	FIREFIGHTING WORKS	
01	4268/04/TD/1J01	FIRE FIGHTING - LIST OF DRAWINGS, GENERAL NOTES, ABBREVIATIONS & LEGENDS
02	4268/04/TD/1J02	FIRE FIGHTING - FIRE SPRINKLER, HOSE REEL SYSTEM PIPING DIAGRAM (MAIN BUILDING)
03	4268/04/TD/1J03	FIRE FIGHTING - BASEMENT PLAN (MAIN BUILDING)
04	4268/04/TD/1J04	FIRE FIGHTING - GROUND FLOOR PLAN (MAIN BUILDING)
05	4268/04/TD/1J05	FIRE FIGHTING - FIRST FLOOR PLAN (MAIN BUILDING)
06	4268/04/TD/1J06	FIRE FIGHTING - SECOND FLOOR PLAN (MAIN BUILDING)
07	4268/04/TD/1J07	FIRE FIGHTING - THIRD FLOOR PLAN (MAIN BUILDING)
08	4268/04/TD/1J08	FIRE FIGHTING - FOURTH FLOOR PLAN (MAIN BUILDING)
09	4268/04/TD/1J09	FIRE FIGHTING - FIFTH FLOOR PLAN (MAIN BUILDING)
10	4268/04/TD/1J10	FIRE FIGHTING - STANDARD DETAILS

NOTES:

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. ALL INSTILLATION SHALL BE AS PER NFPA CODE AND LOCAL CODE AS APPLICABLE.
3. EXHAUST PIPE/MUFFLER OF DIESEL ENGINE SHALL BE OUT SIDE THE PUMP ROOM.
4. CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE PORTABLE FIRE EXTINGUISHERS AS PER NFPA CODE AND SPACE REQUIREMENT.
5. CONTRACTOR SHALL PREPARE DESIGN COORDINATED SHOP DRAWINGS AND SUBMIT FOR APPROVAL.
6. ALL RELEVANT CIVIL WORK INCLUDING PIPE INSULATION & RELATED ACTIVITIES / PROCEDURE REQUIRED FOR COMPELLATION FOR CIVIL WORKS ETC IS INCLUDED IN CONTRACTOR SCOPE OF WORK.
7. SIZES AND DETAILS OF PUMP FOUNDATIONS AND OTHER EQUIPMENT SHALL BE IN ACCORDANCE WITH SPECIFICATION OF THE MANUFACTURE INDICATING EXACT LENGTH AND DIMENSIONS OF PIPES HANGERS AND SUPPORTS.
8. ALL SUPERVISORY SWITCHES, PRESSURE SWITCHES & ONE CONTROL VALVE ASSEMBLIES SHALL BE OF THE ADDRESSABLE TYPE LINKED TO THE MAIN FIRE ALARM CONTROL PANEL.
9. INSPECTOR TEST CONNECTION (ITC) LOCATION IS TENTATIVE AND BE INSTALLED CLOSE TO NEAREST DRAIN POINT AT SITE.
10. FM 200 SYSTEM SHALL BE INTEGRATED TO THE MAIN FIRE ALARM SYSTEM OF THE BUILDING.
11. INDOOR FIRE HOSE CABINETS SHALL BE OF RECESSED TYPE.

ABRV.	DESCRIPTION
ACV	ALARM CONTROL VALVE ASSEMBLY
ZCV	ZONE CONTROL VALVE ASSEMBLY
C / L	CEILING LEVEL
FHR	FIRE HOSE REEL
FHC	FIRE HOSE CABINET
FWR	FIRE WATER RISER
FP - 1	FIRE PUMP ELECTRIC
FP - 2	FIRE PUMP DIESEL (STAND BY)
FWL	FIRE WATER LINE

ABRV.	DESCRIPTION
F / B	FROM BELOW
F / A	FROM ABOVE
JP	JOCKEY PUMP
MG	MOTOR GONG
PS	PRESSURE SWITCH
T / A	TO ABOVE
T / B	TO BELOW
Ø	DIAMETER OF PIPE
ITC	INSPECTOR TEST CONNECTION

SYMBOL	DESCRIPTION
	WATER SPRINKLER (PENDENT/CONCEALED TYPE) 68°C
	WATER SPRINKLER (PENDENT/CONCEALED TYPE) 79°C
	POWDER FIRE EXTINGUISHER
	CARBON DIOXIDE FIRE EXTINGUISHER
	FOAM FIRE EXTINGUISHER
	WET CHEMICAL FIRE EXTINGUISHER
	AUTOMATIC CEILING HANG POWDER FIRE EXTINGUISHER
	INTERNAL CABINET WITH REEL
	FIRE CABINET WITH REEL
	CARBON DIOXIDE FIRE EXTINGUISHER TROLLEY
	POWDER FIRE EXTINGUISHER TROLLEY
	FOAM FIRE EXTINGUISHER TROLLEY
	FIRE BLANKET
FHR 3	EQUIPMENT IDENTIFICATION FIRE HOSE REEL UNIT NO.3
3 02	REFER TO DETAIL 3 OF DRAWING NO.2
4 05	SECTION LINE, SECTION DRAWN AS 4 OF DRAWING NO.5
	CONTROL PANEL
FP	FIRE PUMP
JP	JOCKEY PUMP
F	FIRE LINE
	CHECK VALVE
	GLOBE VALVE
	VALVE OPEN
	VALVE CLOSED
	FLOW METER
P	FLOW SWITCH
	PRESSURE SWITCH
	PRESSURE REDUCING VALVE
	DRAIN COCK
	REDUCER IN PIPE
	PRESSURE RELIEF VALVE

SYMBOL	DESCRIPTION
	STRAINER
	GATE VALVE WITH SUPERVISORY SWITCH
FS	FLOW SWITCH
	ALARM CONTROL VALVE ASSEMBLY
	ZONE CONTROL VALVE ASSEMBLY
	AIR VENT
	PRESSURE GAUGE
	CONCENTRIC REDUCER
	ECCENTRIC REDUCER
	CIRCUIT BREAKER (3 PHASE)
	CIRCUIT BREAKER (1 PHASE)
	CONTACTOR
	RELAY
	LANDING VALVE (DRY TYPE)
	SIAMESE CONNECTION
	LANDING VALVE (DRY TYPE)
	BUS BAR
	LOCAL ISOLATING SWITCH
	VOLTAGE STABILIZER
	MASTER & STANDBY FIRE SUPPRESSION CYLINDER
	FIRE SUPPRESSION NOZZLE 360°
SD	SMOKE DETECTOR (CONVENTIONAL)
HD	HEAT DETECTOR (CONVENTIONAL)
	FIRE ALARM BELL (FIRST STAGE)
	FIRE ALARM BELL WITH FLASHER (SECOND STAGE)
AB	ABORT SWITCH
MCP	MANUAL CALL POINT
FM 200	FM 200 FIRE EXTINGUISHING PANEL
	FIRE SUPPRESSION PIPELINE

TENDER DRAWING

CLIENT:-
HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT:-
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
04			
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DRAWN | SUBMITTED | RECOMMENDED | CHD./VER. | APPROVED

PROJECT:-
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

DRAWING TITLE :- **MAIN BUILDING**
FIREFIGHTING
LIST OF DRAWINGS, GENERAL NOTES, ABBREVIATIONS & LEGENDS

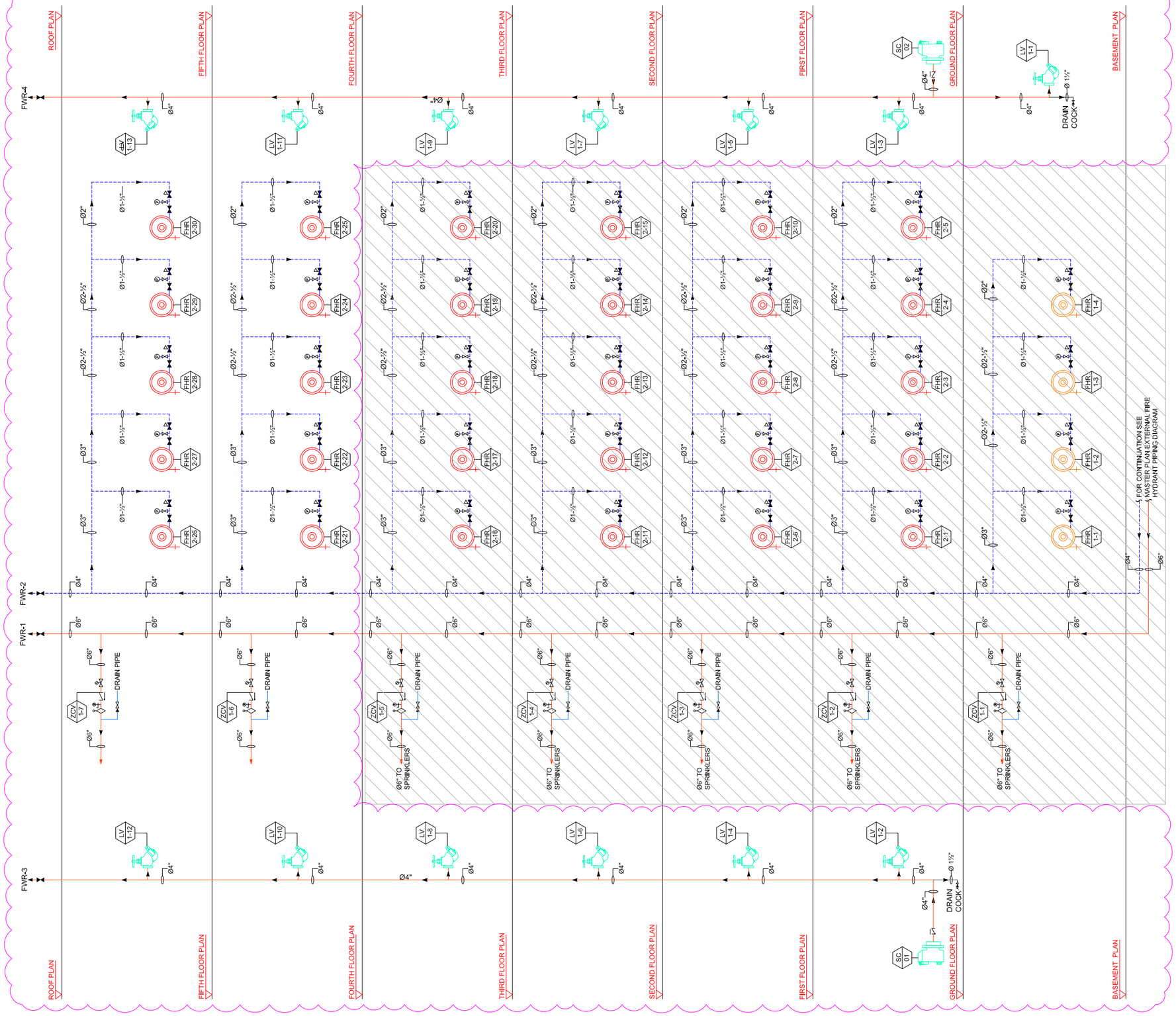
SCALE:- N.T.S

DATE:- APRIL, 2025

DRAWING No:- **4268/04/TD/1J01**

REV. 0

E:\FIREFIGHTING\4268 – SINDH FORENSIC LAB\4268 – FINAL TENDER APRIL, 24, 2025\4268 – 1J01.DWG



NOTES:

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE STATED.
2. FOR LEGENDS, AND GENERAL NOTES PLEASE REFER TO DRAWING NO. 4068/04/TD/1J01.
3. THE FLOW DIAGRAM INSIDE THE CLOUDED PART IS ADDITIONAL TENDER / SCOPE OF WORK ACCORDING TO THE FLOOR PLANS.

TENDER DRAWING

CLIENT:-

HOME DEPARTMENT,
GOVERNMENT OF SINDH

CONSULTANT:-

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road,
Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
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DRAWN	
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT:-

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

DRAWING TITLE :- **MAIN BUILDING**
FIREFIGHTING
FIRE SPRINKLER, HOSE REEL SYSTEM PIPING DIAGRAM

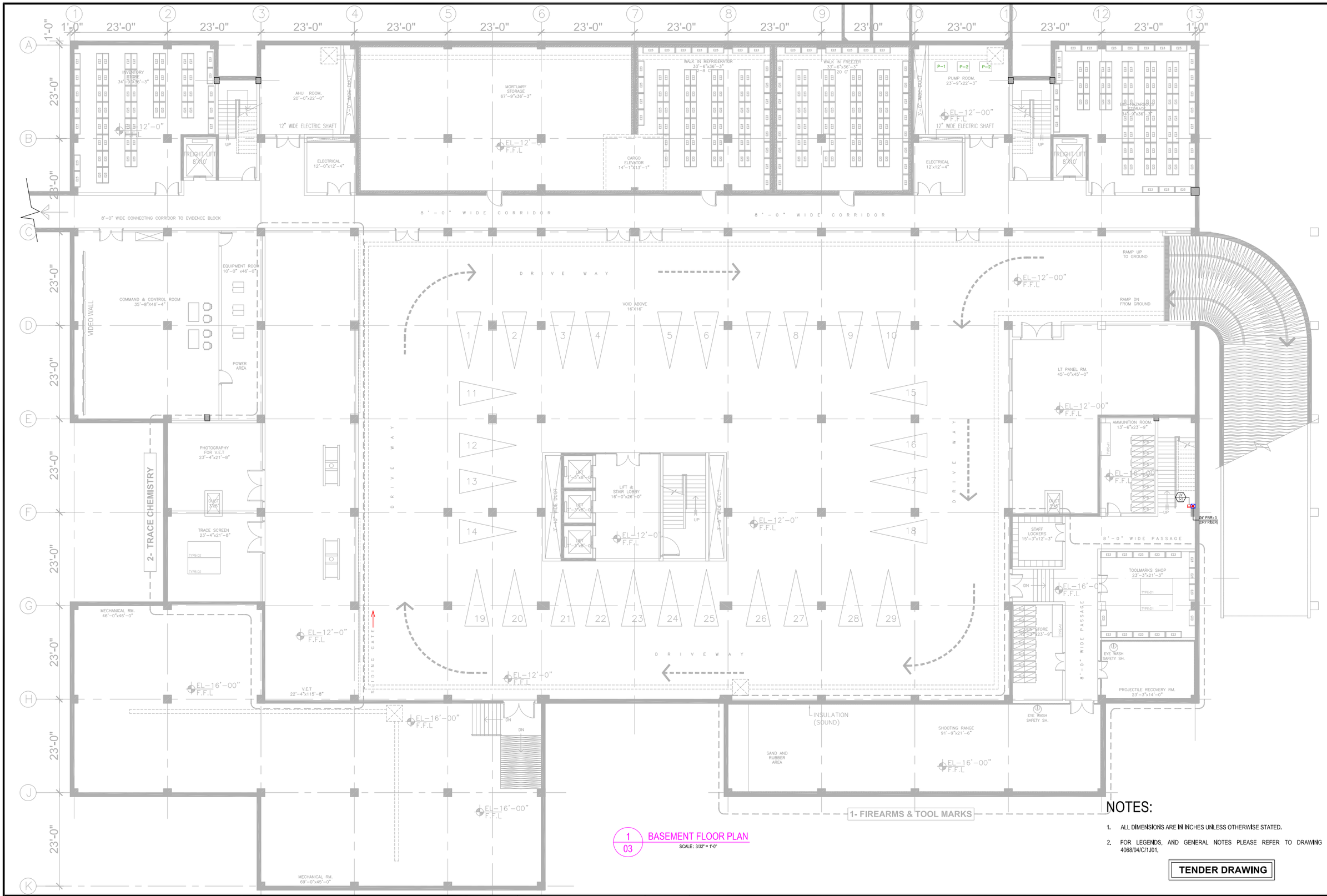
SCALE:- N.T.S

DATE:- APRIL, 2025

DRAWING No:- **4068/04/TD/1J02**

REV. 0

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1/03 BASEMENT FLOOR PLAN
SCALE : 3/32" = 1'-0"

NOTES:

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE STATED.
2. FOR LEGENDS, AND GENERAL NOTES PLEASE REFER TO DRAWING NO. 4068/04/C/1J01.

TENDER DRAWING

CLIENT:-
HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT:-
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi,
Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED	APPROVED
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03				SUBMITTED
02				RECOMMENDED
01	--	--		CHD./VER.

PROJECT:-
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

DRAWING TITLE :- **MAIN BUILDING** FIREFIGHTING BASEMNT FLOOR PLAN

SCALE:- 3/32" = 1'-0"

DATE:- APRIL, 2025

DRAWING No:- **4268/04/TD/1J03**

REV. 0

E:\FIREFIGHTING\4268 – SINDH FORENSIC LAB\4268 – FINAL TENDER APRIL, 24, 2025\4268 – 1J03 TO 1J09.DWG

3- LATENT FINGER PRINT

2- CRIME SCENE UNIT

1- FIREARMS & TOOL MARKS

5- POLYGRAPH

1 / 04 GROUND FLOOR PLAN

SCALE: 3/32" = 1'-0"

NOTES:

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE STATED.
2. FOR LEGENDS, AND GENERAL NOTES PLEASE REFER TO DRAWING NO. 4068/04/C/1J01.

TENDER DRAWING

CLIENT:-

HOME DEPARTMENT,
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CONSULTANT:-

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REV.	DATE	DESCRIPTION	APPROVED
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PROJECT:-

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

DRAWING TITLE :- **MAIN BUILDING**
FIREFIGHTING
GROUND FLOOR PLAN

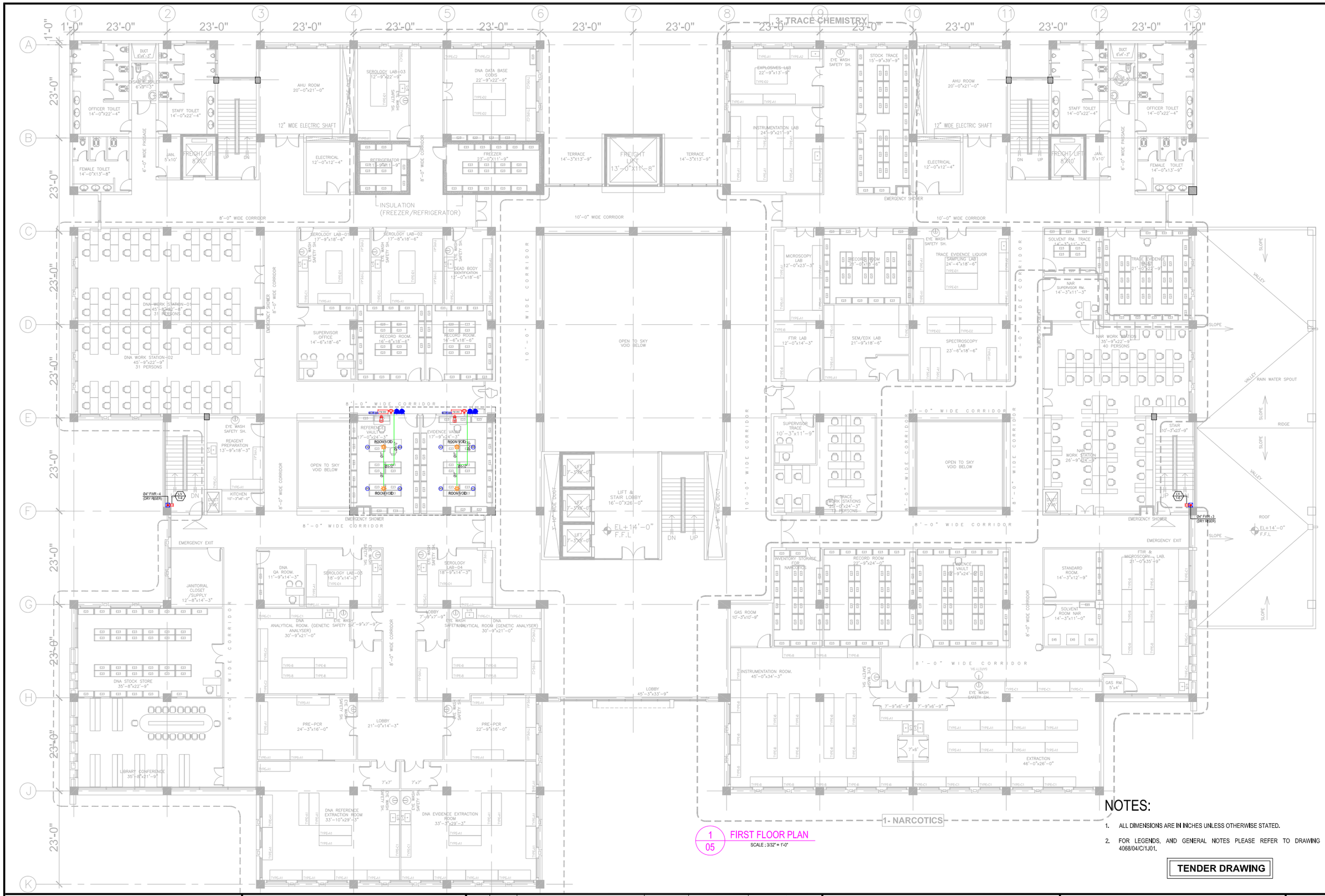
DATE:- APRIL, 2025

DRAWING No:- **4268/04/TD/1J04**

SCALE:- 3/32" = 1'-0"

REV. 0

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1 / 05 FIRST FLOOR PLAN
SCALE : 3/32" = 1'-0"

NOTES:

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE STATED.
2. FOR LEGENDS, AND GENERAL NOTES PLEASE REFER TO DRAWING NO. 4068/04/C/1J01.

TENDER DRAWING

CLIENT:-
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4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi,
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REV.	DATE	DESCRIPTION	APPROVED	APPROVED
04				DRAWN
03				SUBMITTED
02				RECOMMENDED
01	--	--		CHD./VER.

PROJECT:-
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

DRAWING TITLE :- **MAIN BUILDING**
FIREFIGHTING
FIRST FLOOR PLAN

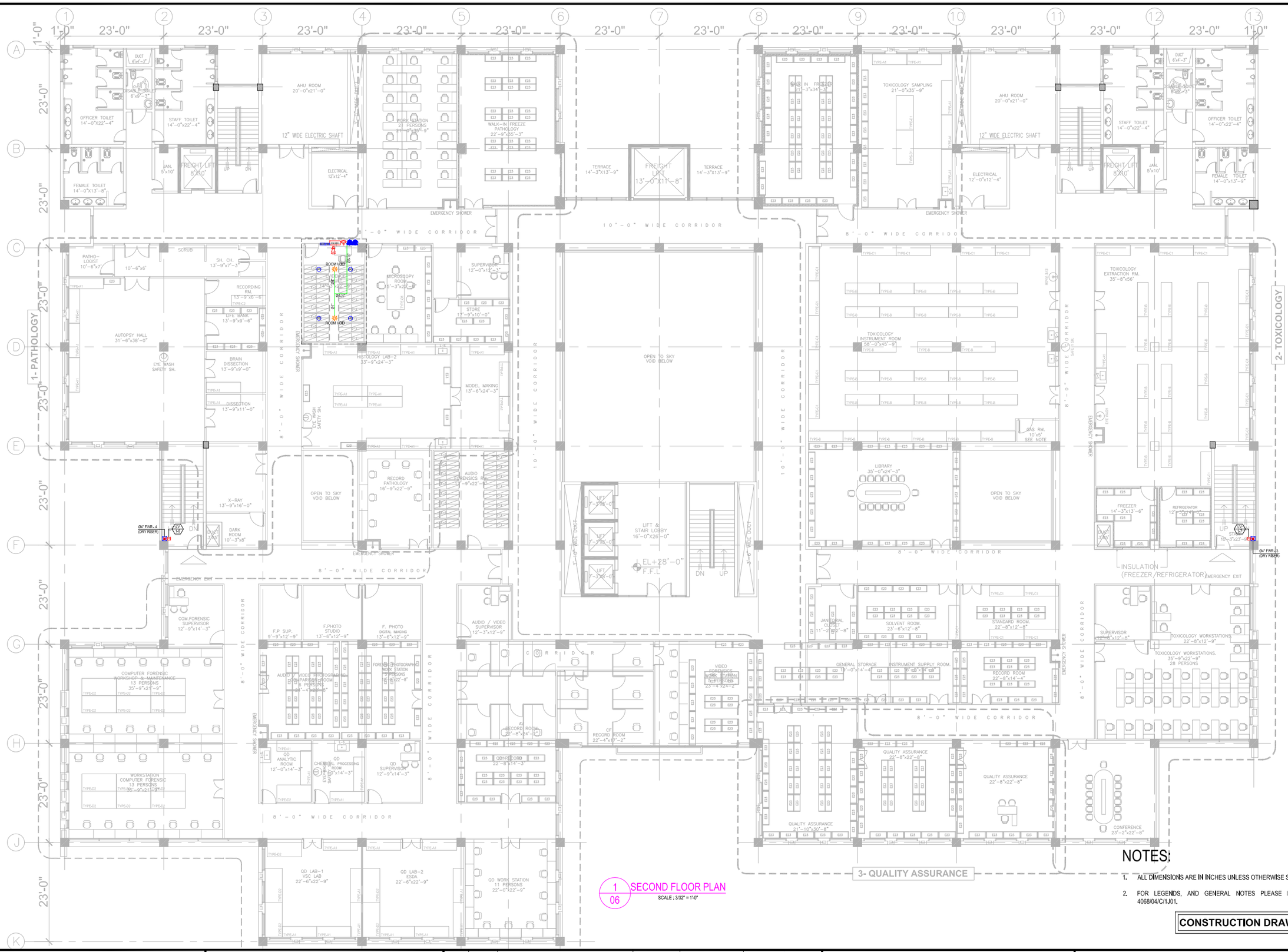
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DATE:- APRIL, 2025

DRAWING No:- **4268/04/TD/1J05**

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1 / 06 SECOND FLOOR PLAN
SCALE : 3/32" = 1'-0"

NOTES:

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE STATED.
2. FOR LEGENDS, AND GENERAL NOTES PLEASE REFER TO DRAWING NO. 4068/04/C/1J01.

CONSTRUCTION DRAWING

CLIENT:-
HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT:-
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
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4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi,
Tel: 99225430-34

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04				DRAWN
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				APPROVED

PROJECT:-
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

DRAWING TITLE :-
MAIN BUILDING
FIREFIGHTING
SECOND FLOOR PLAN

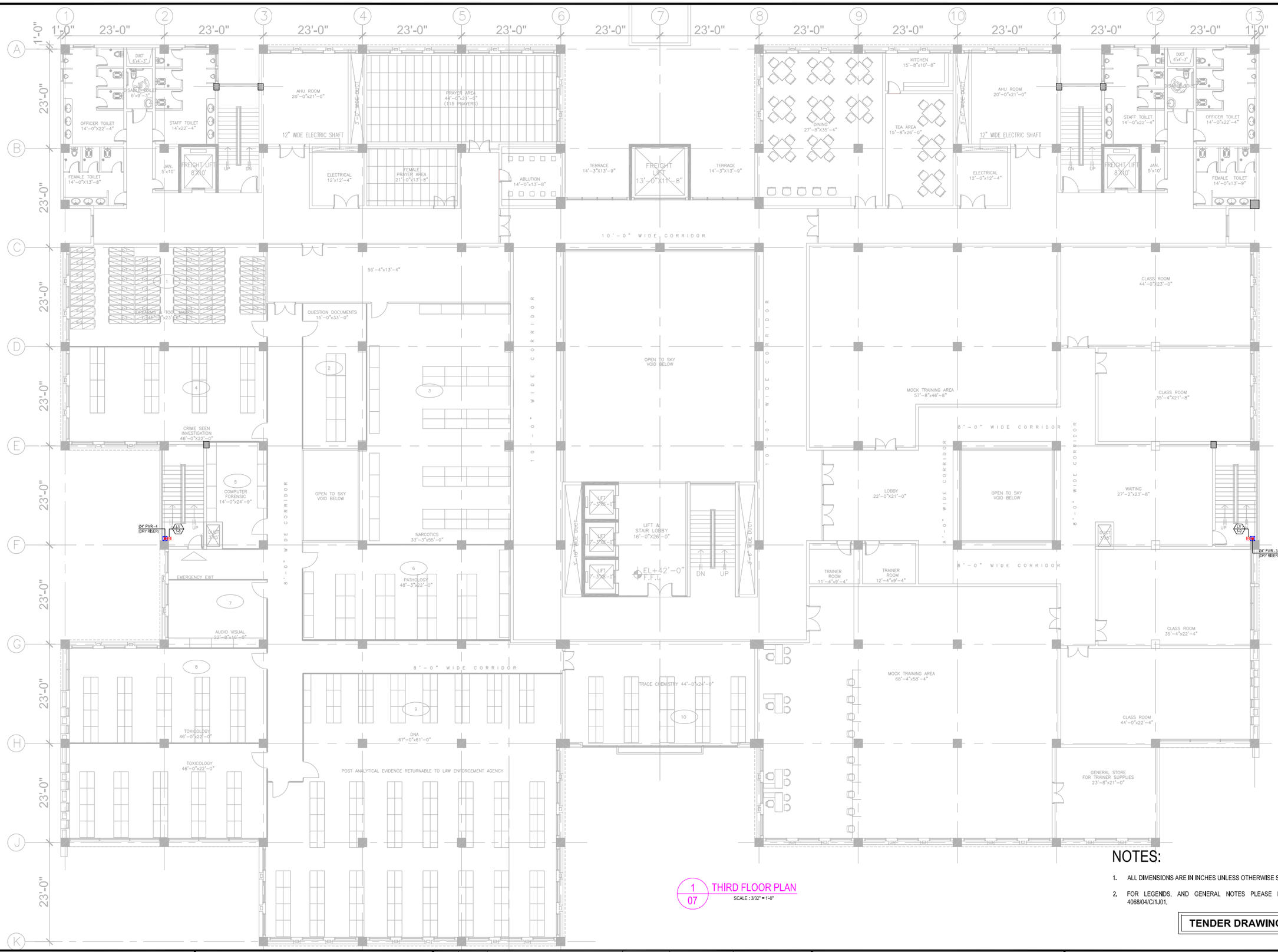
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DATE:- APRIL, 2025

DRAWING No:- **4268/04/TD/1J06**

REV. 0

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1/07 THIRD FLOOR PLAN
SCALE : 3/32" = 1'-0"

NOTES:

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE STATED.
2. FOR LEGENDS, AND GENERAL NOTES PLEASE REFER TO DRAWING NO. 4068/04/C/1J01.

TENDER DRAWING

CLIENT:-
HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT:-
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi,
Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
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PROJECT:-
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

DRAWING TITLE :- **MAIN BUILDING**
FIREFIGHTING
THIRD FLOOR PLAN

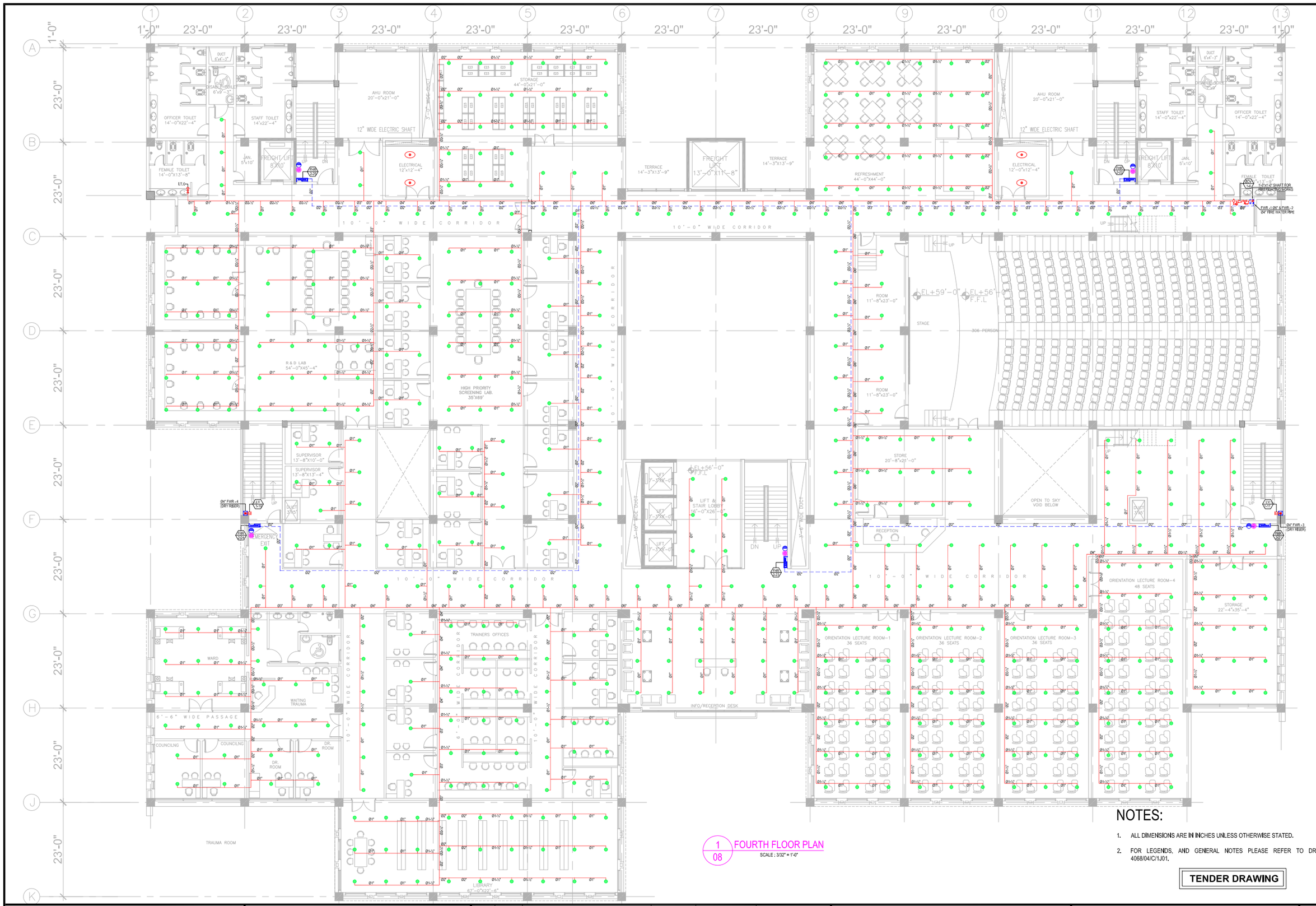
DATE:- APRIL, 2025

DRAWING No:- **4268/04/TD/1J07**

SCALE:- 3/32" = 1'-0"

REV. 0

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1/08 FOURTH FLOOR PLAN
SCALE : 3/32" = 1'-0"

NOTES:

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE STATED.
2. FOR LEGENDS, AND GENERAL NOTES PLEASE REFER TO DRAWING NO. 4068/04/C/1J01.

TENDER DRAWING

CLIENT:-
HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT:-
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi,
Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
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02			
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DRAWN | SUBMITTED | RECOMMENDED | CHD./VER. | APPROVED

PROJECT:-
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

DRAWING TITLE :- **MAIN BUILDING** FIREFIGHTING FOURTH FLOOR PLAN

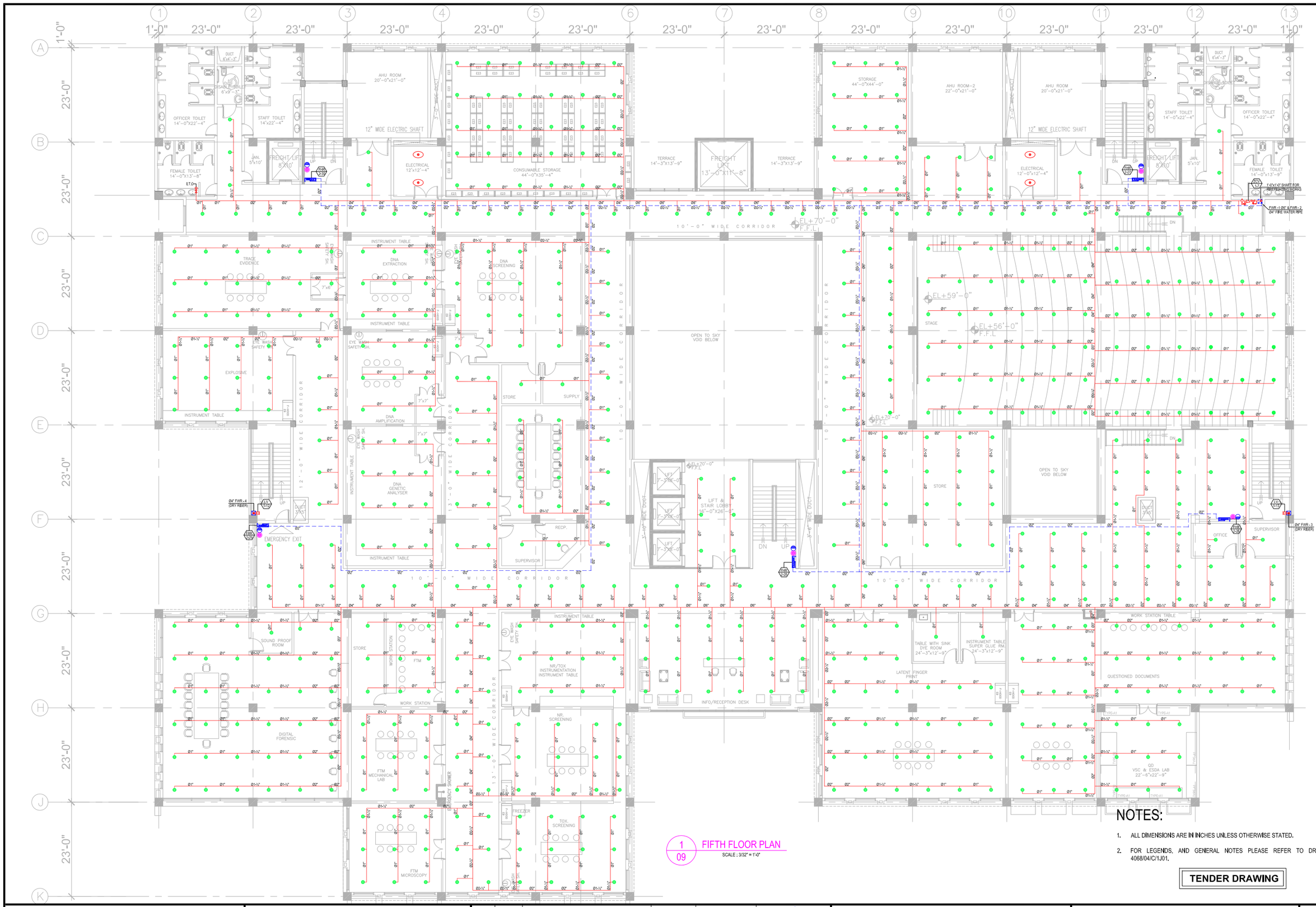
DATE:- APRIL, 2025

DRAWING No:- **4268/04/TD/1J08**

SCALE:- 3/32" = 1'-0"

REV. 0

E:\FIREFIGHTING\4268 – SINDH FORENSIC LAB\4268 – FINAL TENDER APRIL, 24, 2025\4268 – 1J03 TO 1J09.DWG



1/09 FIFTH FLOOR PLAN
SCALE : 3/32" = 1'-0"

NOTES:

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE STATED.
2. FOR LEGENDS, AND GENERAL NOTES PLEASE REFER TO DRAWING NO. 4068/04/C/1J01.

TENDER DRAWING

CLIENT:-
HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT:-
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi,
Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED	APPROVED
04				DRAWN
03				SUBMITTED
02				RECOMMENDED
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PROJECT:-
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

DRAWING TITLE :- **MAIN BUILDING** FIREFIGHTING FIFTH FLOOR PLAN

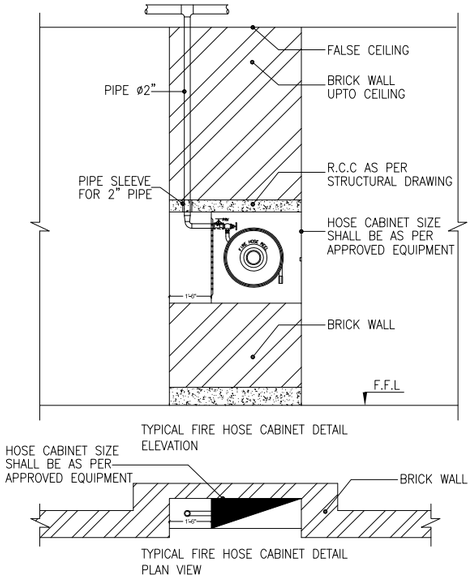
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DATE:- APRIL, 2025

DRAWING No:- **4268/04/TD/1J09**

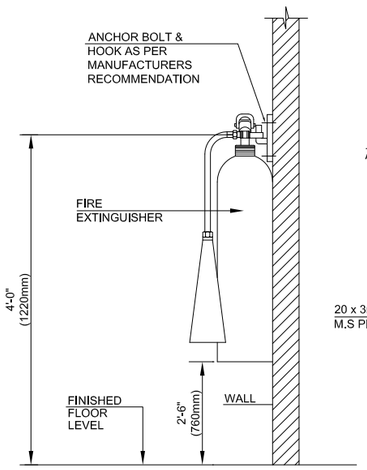
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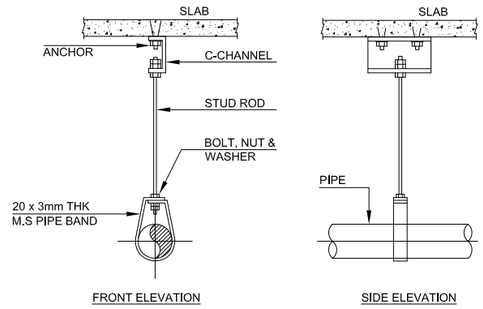


TYPICAL FIRE HOSE CABINET DETAIL ELEVATION

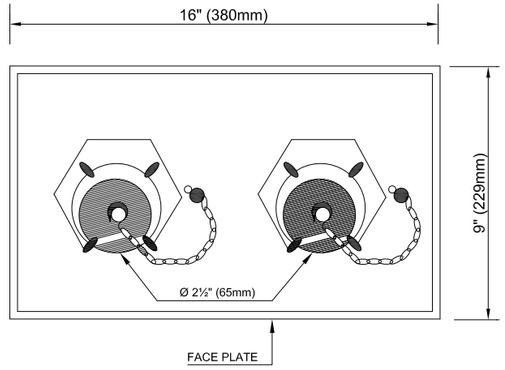
TYPICAL FIRE HOSE CABINET DETAIL PLAN VIEW



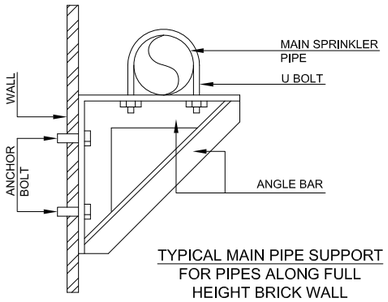
PORTABLE FIRE EXTINGUISHER MOUNTING DETAIL



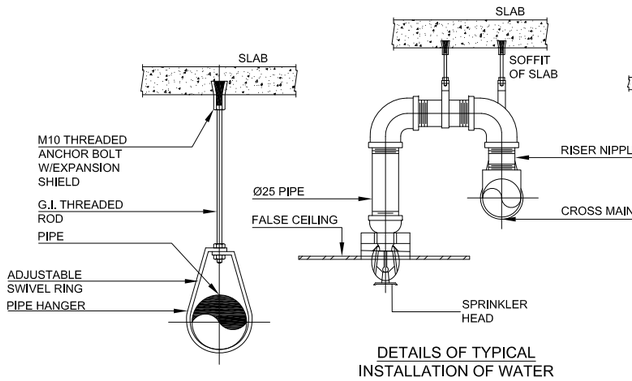
TYPICAL MAIN PIPE HANGER SUPPORT FOR PIPE 25mm DIA TO 200mm DIA



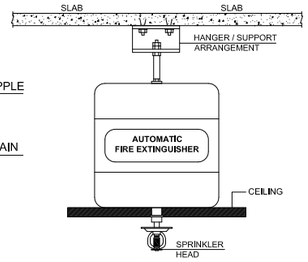
DETAIL OF SIAMESE CONNECTION



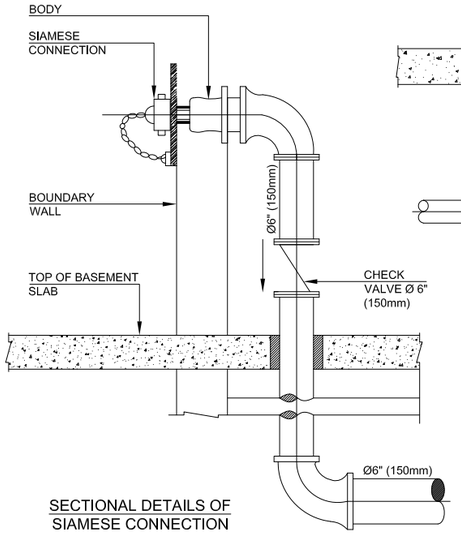
TYPICAL MAIN PIPE SUPPORT FOR PIPES ALONG FULL HEIGHT BRICK WALL



DETAILS OF TYPICAL INSTALLATION OF WATER SPRINKLERS (TYPE PENDENT)

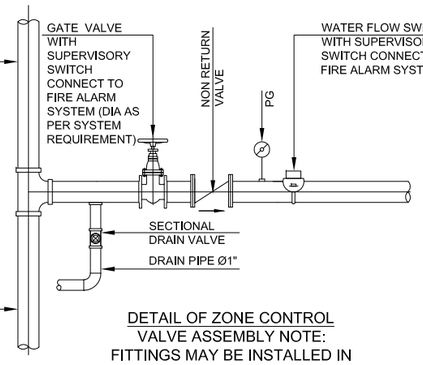


TYPICAL INSTALLATION DETAIL OF AUTOMATIC FIRE EXTINGUISHER



SECTIONAL DETAILS OF SIAMESE CONNECTION

TYPICAL SPRINKLER INSTALLATION UNDER DUCT WORK



DETAIL OF ZONE CONTROL VALVE ASSEMBLY NOTE: FITTINGS MAY BE INSTALLED IN RISER AS PER SITE CONDITION

NOTES:

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE STATED.
2. FOR LEGENDS, AND GENERAL NOTES PLEASE REFER TO DRAWING NO. 4068/04/TD/1J01.

TENDER DRAWING

CLIENT:-
HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT:-
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
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SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT:-
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

DRAWING TITLE :- **MAIN BUILDING**
FIREFIGHTING
STANDARD DETAILS & ELECTRICAL DISTRIBUTION DIAGRAM

SCALE:- N.T.S

DATE:- APRIL, 2025

DRAWING No:- **4268/04/TD/1J10**

REV. 0

E:\FIREFIGHTING\4268 – SINDH FORENSIC LAB\4268 – FINAL TENDER APRIL, 24, 2025\4268 – 1J10.DWG

GENERAL NOTES:

1– ALL DRAWINGS SHALL BE READ IN CONJUNCTION WITH ITEMS OF BOQ, AND TECHNICAL SPECIFICATIONS.

2– ACTUAL LOCATION OF ALL OUTLETS MUST ME VERIFIED BY THE SITE ENGINEER BEFORE INSTALLATION STARTS.

3– ALL DRAWINGS SHALL BE COORDINATED WITH OTHER DISCIPLINES WORKS FOR ROUTING, SPACING AND INSTALLATIONS.

4– CO–ORDINATE AT SITE WITH EXACT FURNITURE PLACEMENT AND OTHER SERVICES FOR EXACT LOCATION AND POSITION OF NETWORK NODES AND CONDUITS FOR IT, SECURITY & ELV SYSTEM EQUIPMENT/DEVICES.

5– DIMENSIONS/MEASUREMENTS GIVEN IN LAYOUTS ARE APPROXIMATE. THE CONTRACTOR SHALL BE RESPONSIBLE TO CALCULATE ACTUAL DIMENSIONS/MEASUREMENTS ACCORDING TO STRUCTURE AND ARCHITECTURE DRAWINGS.

6– THE ROUTES OF CABLE TRAY, PIPES AND DUCTS SHALL BE FOLLOWED AS SHOWN ON THE DRAWING, ANY CHANGE IN ROUTES REQUIRED DUE TO SITE CONDITIONS SHALL BE MADE IN CO–ORDINATION WITH OTHER SERVICES, AFTER OBTAINING ENGINEER'S APPROVAL .

7– WHERE CABLES ENTER BUILDINGS, THESE SHALL BE LAID IN PROTECTIVE PIPES. HAND HOLE SHALL BE PROVIDED OUTSIDE THE BUILDING.

8– ALL UNDERGROUND PIPES SHALL BE LAID MINIMUM 1.5 FEET BELOW THE TOP OF PAVEMENT THE DEPTH MAY BE INCREASED / DECREASED DUE TO THE SITE CONDITIONS AFTER OBTAINING ENGINEERS APPROVAL

9– ALL UNDERGROUND PIPES, MAN HOLES & HANDHOLES SHALL BE PROPERLY SEALED WATER TIGHT AT ENDS/JOINTS AFTER INSTALLATION.

10– SPARE PIPES SHALL HAVE THEIR ENDS PROPERLY PLUGGED WITH CAP AND MADE WATER TIGHT. BOTH ENDS OF PIPES SHALL BE MARKED BY PIPE END MARKERS FOR IDENTIFICATION.

11– CABLE MARKERS SHALL BE PROVIDED AT 30 METER INTERVALS ALONG STRAIGHT RUNS OF CABLE DUCT / ROUTE AND AT EACH BEND.

12– ALL ROUTING OF PIPES, PIPE DUCTS & CONNECTION DETAILS SHALL BE CARRIED OUT WITH THE APPROVAL OF THE ENGINEER.

13– MANUFACTURER'S RECOMMENDATION SHALL BE FOLLOWED FOR INSTALLATION OF ALL IT, SECURITY & EVL SYSTEMS.

14– THE CONTRACTOR SHALL TAKE THE RESPONSIBILITIES OF GENERAL INTEGRATOR FOR ALL THE SUB–SYSTEMS AND EQUIPMENT WITHIN THE SCOPE OF WORK INCLUDING INTERFACES WITH OTHER SYSTEMS.

15– ALL IT, SECURITY & EVL SYSTEMS SHALL BE FED FROM UNINTERRUPTED POWER SUPPLY (UPS).

16– WHERE NETWORK NODES ARE SHOWN, FACE PLATES SHALL BE INSTALLED IN SAME HORIZONTAL LINE.

17– CONTRACTOR SHALL SUBMIT SOUND PRESSURE LEVEL (SPL) CALCULATION OF SPEAKERS ON THE LAYOUT DRAWINGS OF SINDH FORENSIC SCIENCE LAB FOR REVIEW AND APPROVAL OF ENGINEER.

18– CONTRACTOR SHALL SUBMIT CO–ORDINATION SHOP DRAWING OF IT, SECURITY & EVL SYSTEMS LAYOUT WITH POWER LAYOUT BEFORE EXECUTION OF WORKS.

19– CONTRACTOR SHALL CO–ORDINATE WITH HVAC LAYOUT FOR PLACEMENT OF RACKS IN DATA CENTER AND COMMAND AND CONTROL ROOM/COMMUNICATION EQUIPMENT ROOM.

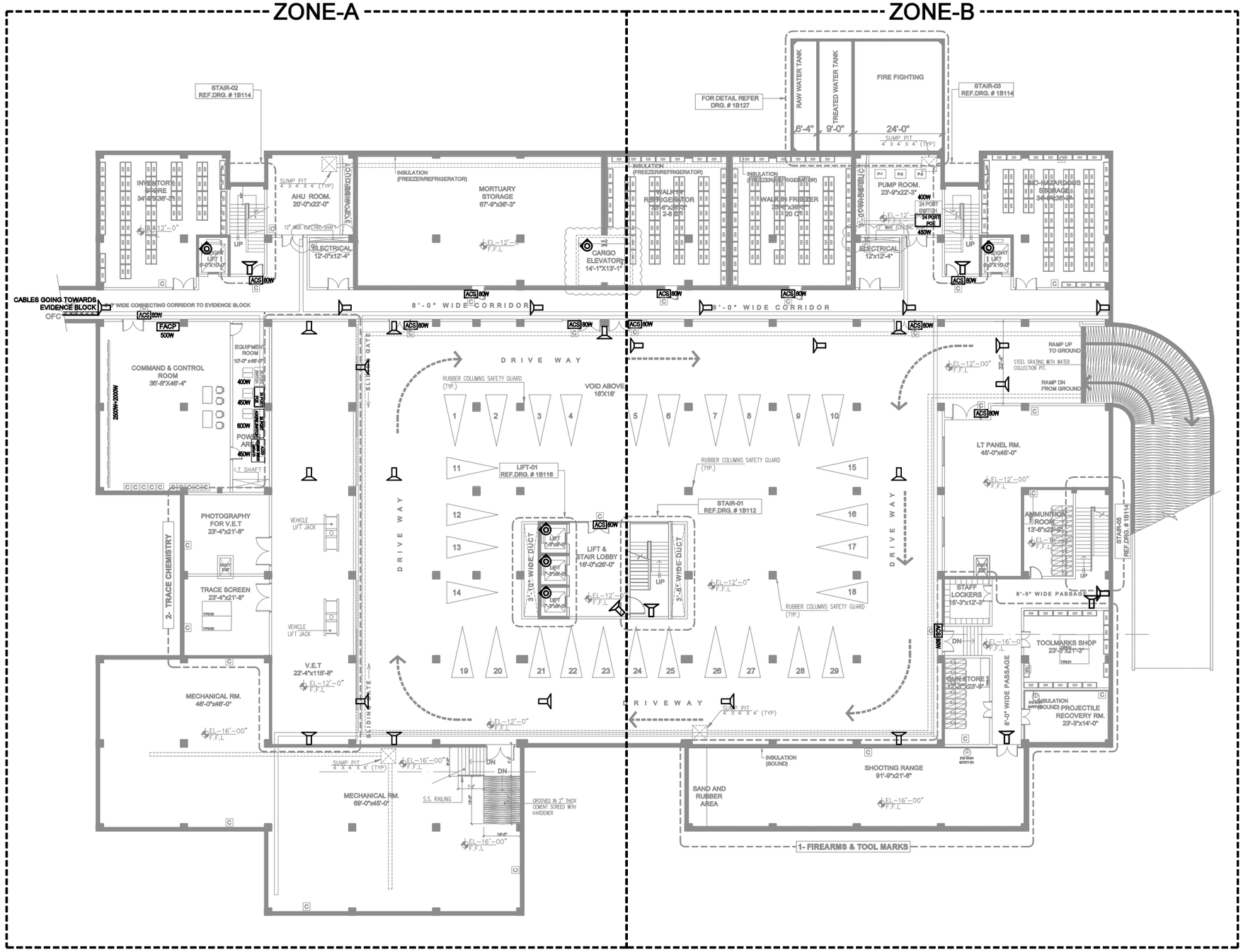
20– CONTRACTOR SHALL CO–ORDINATE WITH FIRE FIGHTING LAYOUT FOR PLACEMENT OF IT EQUIPMENT IN DATA CENTER.

21– CONTRACTOR SHALL SUBMIT CO–ORDINATION DRAWING SHOWING MOUNTING DETAIL AND HEIGHT OF ACCESS POINTS, CCTV CAMERA, BIOMETRIC/PROXIMITY READERS, MULTIMEDIA PROJECTOR WITH SCREEN AND LED SCREEN ETC. IN PROPER CO–ORDINATION WITH LIGHTS, FANS ETC. AND OTHER RELEVANT ITEMS.

22– ALL EQUIPMENT/MATERIAL SHALL BE SUPPLIED FROM APPROVED MANUFACTURER.

CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH	CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. ARCHITECTURE & PLANNING DIVISION KARACHI. 4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34	04				DRAWN		PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI	MAIN BUILDING GENERAL NOTES	SCALE: 3/64"=1'-0"
		03				SUBMITTED				
		02				RECOMMENDED				
		01				CHD./VER.			DATE: APRIL, 2023	DRAWING No.: 4268/04/CD/1IT100
		REV.	DATE	DESCRIPTION	APPROVED	APPROVED				REV.: 0

E:\MAIN BUILDING.DWG
3/64"=1'-0" SHEET SIZE: A2



LEGEND:

SYMBOL	DESCRIPTION
C	COMPUTER NODE
	2MP FIXED LENS BULLET CAMERA
	4MP FIXED LENS BULLET CAMERA
	4MP DOME CAMERA
24 PORT POE	24 PORT POE SWITCH
24 PORT SWITCH	24 PORT NON POE SWITCH
24 PORT AGGRE.SWITCH	24 PORT AGGREGATION SWITCH
12 PORT CORE SWITCH CCTV	12 PORT CORE SWITCH CCTV
ACS	ACCESS CONTROL SYSTEM
	UTP CABLE RUNNING IN CABLE TRAY FIBER CABLE RUNNING IN CABLE TRAY
OFC	PA,FA & OFC CABLES COMING FROM MAIN BUILDING

BASMENT FLOOR PLAN

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

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SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
BASEMENT FLOOR PLAN
LOCAL AREA NETWORK,CCTV & ACCESS CONTROL SYSTEMS LAYOUT

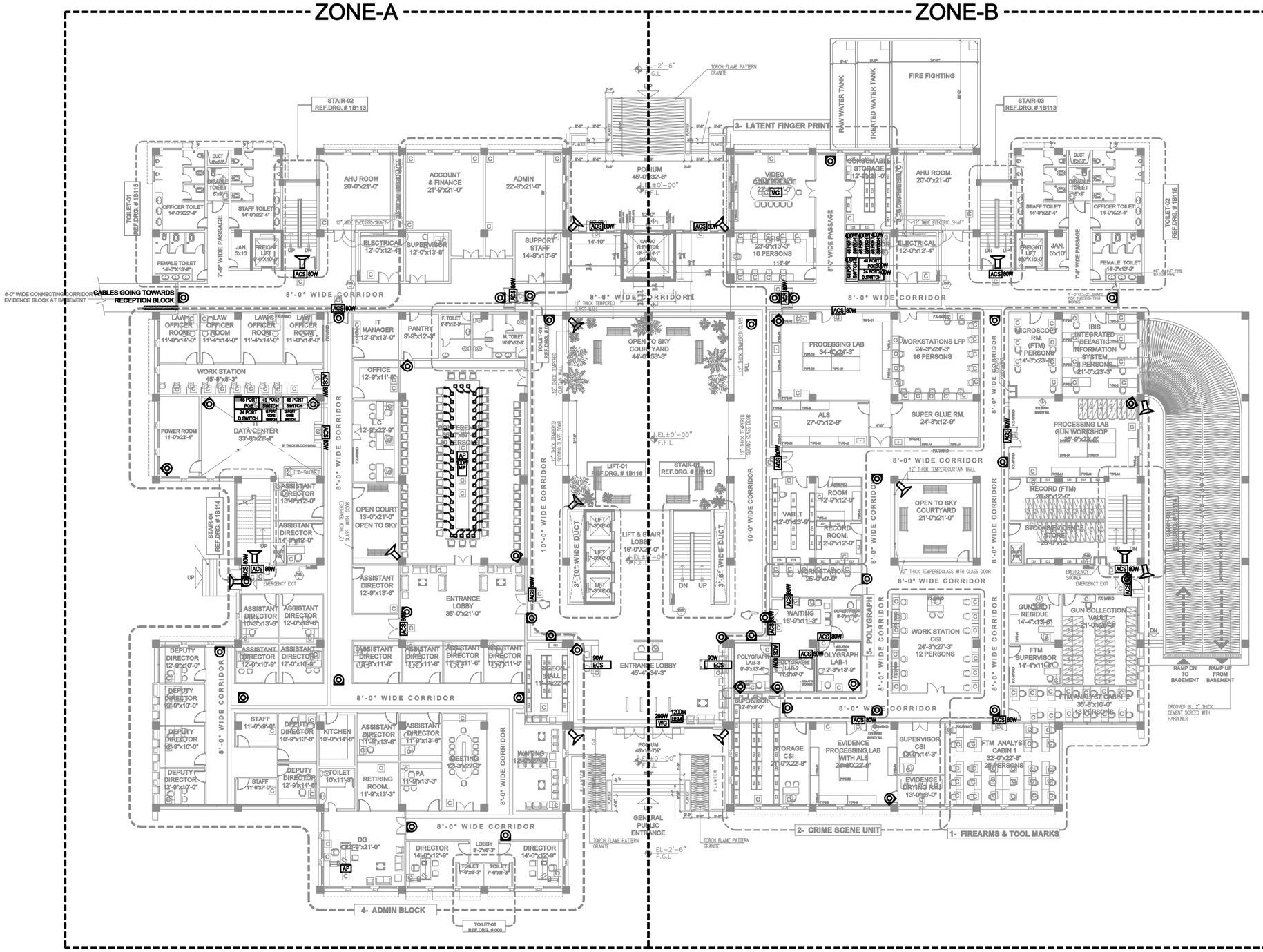
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DATE: APRIL, 2023

DRAWING No.: 4268/04/CD/1IT101

REV.: 0

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3/64"=1'-0" SHEET SIZE: A2



LEGEND:

SYMBOL	DESCRIPTION
C	COMPUTER NODE
	2MP FIXED LENS BULLET CAMERA
	4MP FIXED LENS BULLET CAMERA
	4MP DOME CAMERA
48 PORT POE	48 PORT POE SWITCH
48 PORT SWITCH	48 PORT NON POE SWITCH
24 PORT D.SWITCH	24 PORT DISTRIBUTION SWITCH
12 PORT CORE SWITCH	12 PORT CORE SWITCH
MP	MULTIMEDIA PROJECTOR SYSTEM
ECS	EMPLOYEE ATTENDANCE SYSTEM
WG	WALK THROUGH GATE
VC	VIDEO CONFERENCE SYSTEM
ACS	ACCESS CONTROL SYSTEM
AP	ACCESS POINT SYSTEM
BSM	BAGGAGE SCANNING MACHINE
	UTP CABLE RUNNING IN CABLE TRAY FIBER CABLE RUNNING IN CABLE TRAY
OFC	PA,FA & OFC CABLES COMING FROM MAIN BUILDING
	MICROPHONE CONFERENCE SYSTEM

GROUND FLOOR PLAN

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

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APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
GROUND FLOOR PLAN
LOCAL AREA NETWORK, WIRELESS LOCAL AREA NETWORK, CCTV, MULTIMEDIA PROJECTOR, EMPLOYEE ATTENDANCE, WALK THROUGH GATE, VIDEO CONFERENCE, ACCESS CONTROL, BAGGAGE SCANNING MACHINE & MICROPHONE CONFERENCE SYSTEMS LAYOUT

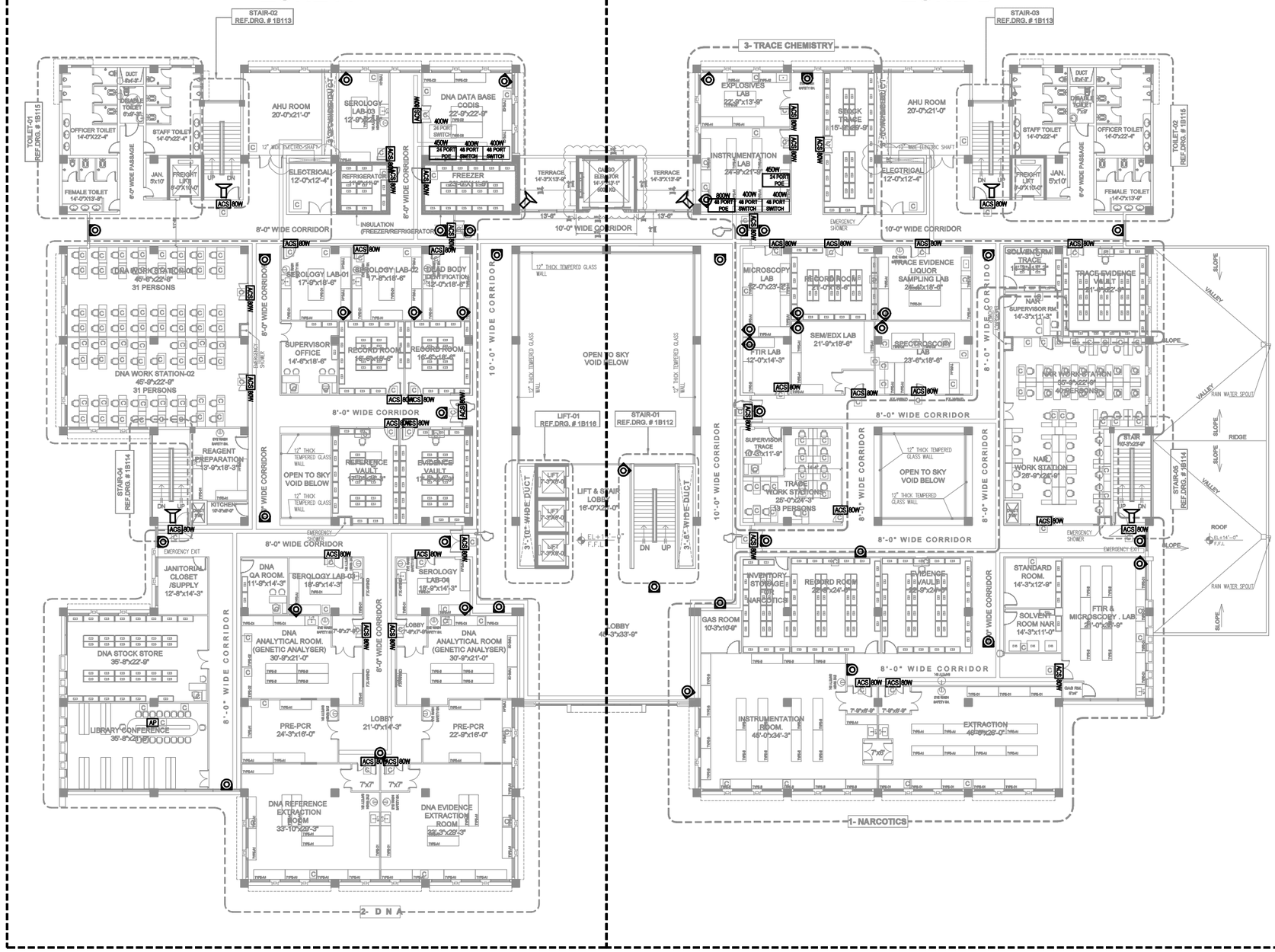
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DATE: APRIL, 2023

DRAWING No.: 4268/04/CD/1IT102

REV.: 0

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3/64"=1'-0" SHEET SIZE: A2



LEGEND:

SYMBOL	DESCRIPTION
C	COMPUTER NODE
	2MP FIXED LENS BULLET CAMERA
	4MP DOME CAMERA
24 PORT POE	24 PORT POE SWITCH
24 PORT SWITCH	24 PORT NON POE SWITCH
48 PORT POE	48 PORT POE SWITCH
48 PORT SWITCH	48 PORT NON POE SWITCH
ACS	ACCESS CONTROL SYSTEM
AP	ACCESS POINT SYSTEM
	UTP CABLE RUNNING IN CABLE TRAY FIBER CABLE RUNNING IN CABLE TRAY
OFC	PA,FA & OFC CABLES COMING FROM MAIN BUILDING

1ST FLOOR PLAN

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
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APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
FIRST FLOOR PLAN
LOCAL AREA NETWORK, WIRELESS LOCAL AREA NETWORK, CCTV & ACCESS CONTROL SYSTEMS LAYOUT

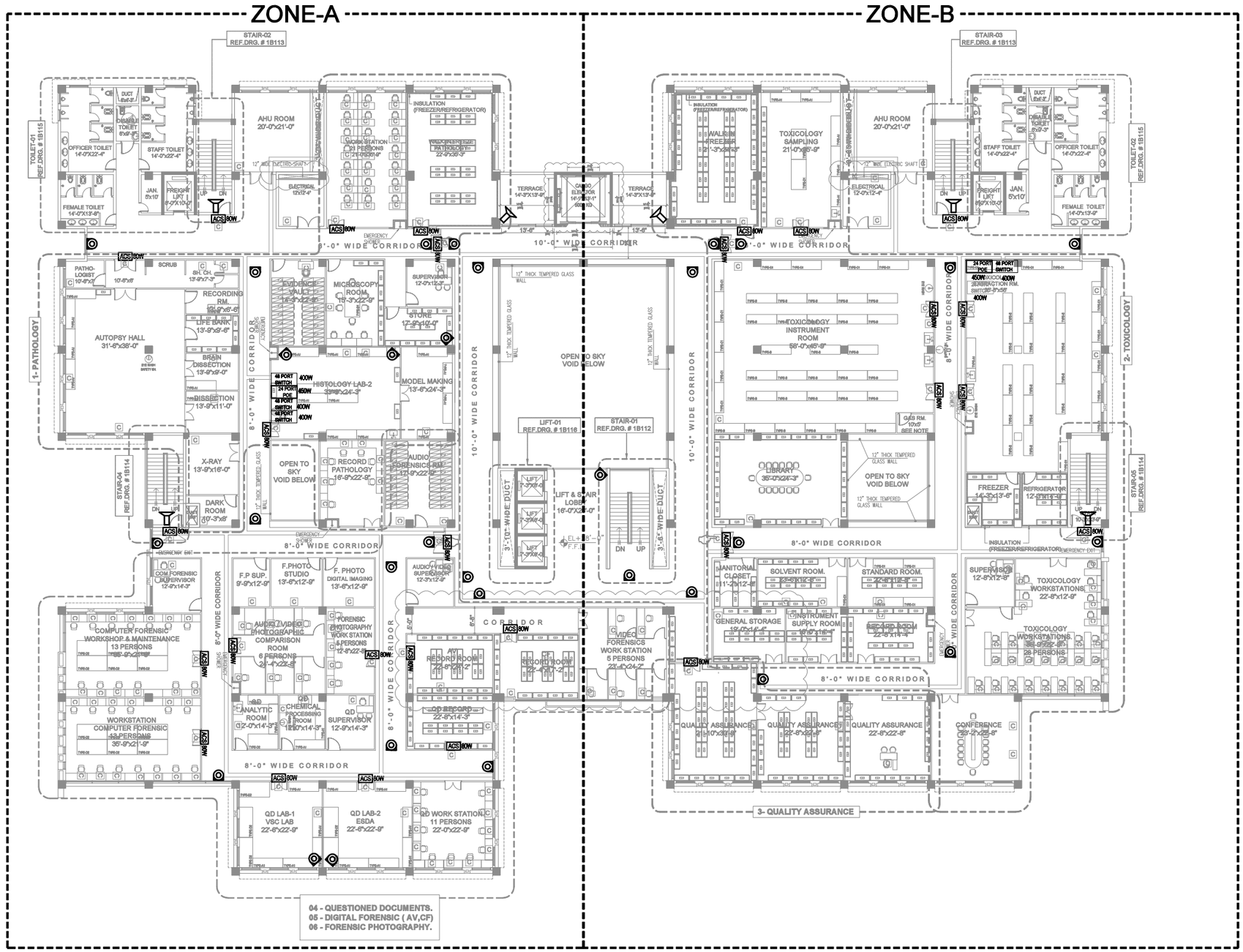
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DATE: APRIL, 2023

DRAWING No.: 4268/04/CD/1IT103

REV.: 0

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3/64"=1'-0" SHEET SIZE - A3



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LEGEND:

SYMBOL	DESCRIPTION
C	COMPUTER NODE
	2MP FIXED LENS BULLET CAMERA
	4MP DOME CAMERA
24 PORT POE	24 PORT POE SWITCH
24 PORT SWITCH	24 PORT NON POE SWITCH
48 PORT SWITCH	48 PORT NON POE SWITCH
ACS	ACCESS CONTROL SYSTEM
	UTP CABLE RUNNING IN CABLE TRAY FIBER CABLE RUNNING IN CABLE TRAY
OFC	PA,FA & OFC CABLES COMING FROM MAIN BUILDING

2ND FLOOR PLAN

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
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CHD./VER.	
APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
SECOND FLOOR PLAN
LOCAL AREA NETWORK, CCTV & ACCESS CONTROL SYSTEMS LAYOUT

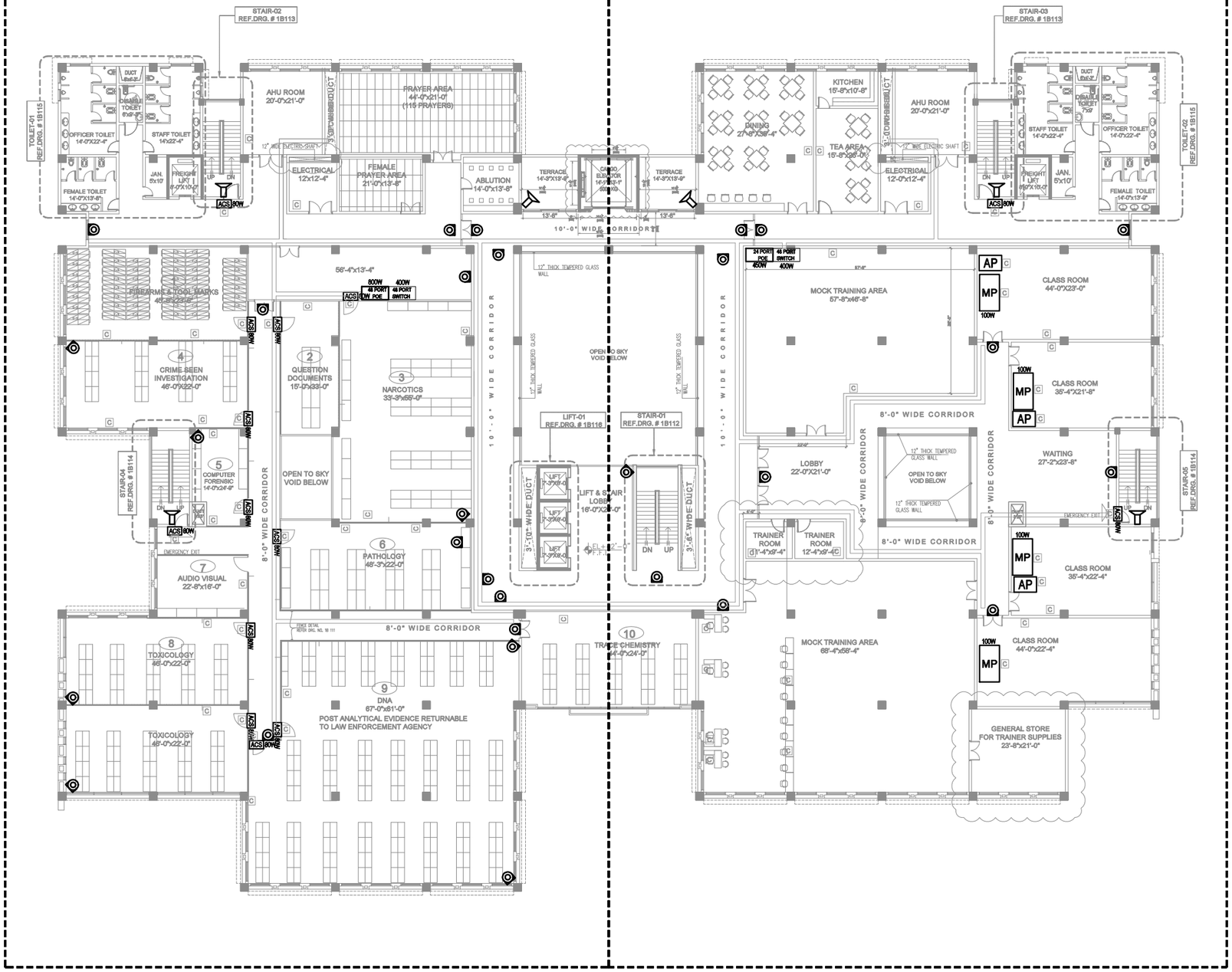
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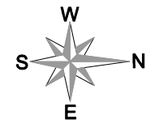
DATE: APRIL, 2023

DRAWING No.: 4268/04/CD/1IT104

REV.: 0

E:\MAIN BUILDING.DWG
3/64"=1'-0" SHEET SIZE: A2





LEGEND:

SYMBOL	DESCRIPTION
C	COMPUTER NODE
	2MP FIXED LENS BULLET CAMERA
	4MP DOME CAMERA
24 PORT POE	24 PORT POE SWITCH
48 PORT POE	48 PORT POE SWITCH
48 PORT SWITCH	48 PORT NON POE SWITCH
MP	MULTIMEDIA PROJECTOR SYSTEM
ACS	ACCESS CONTROL SYSTEM
AP	ACCESS POINT SYSTEM
	UTP CABLE RUNNING IN CABLE TRAY FIBER CABLE RUNNING IN CABLE TRAY
OFC	PA,FA & OFC CABLES COMING FROM MAIN BUILDING

3RD FLOOR PLAN

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

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4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

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RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
THIRD FLOOR PLAN
LOCAL AREA NETWORK, WIRELESS LOCAL AREA NETWORK, CCTV, MULTIMEDIA PROJECTOR & ACCESS CONTROL SYSTEMS LAYOUT

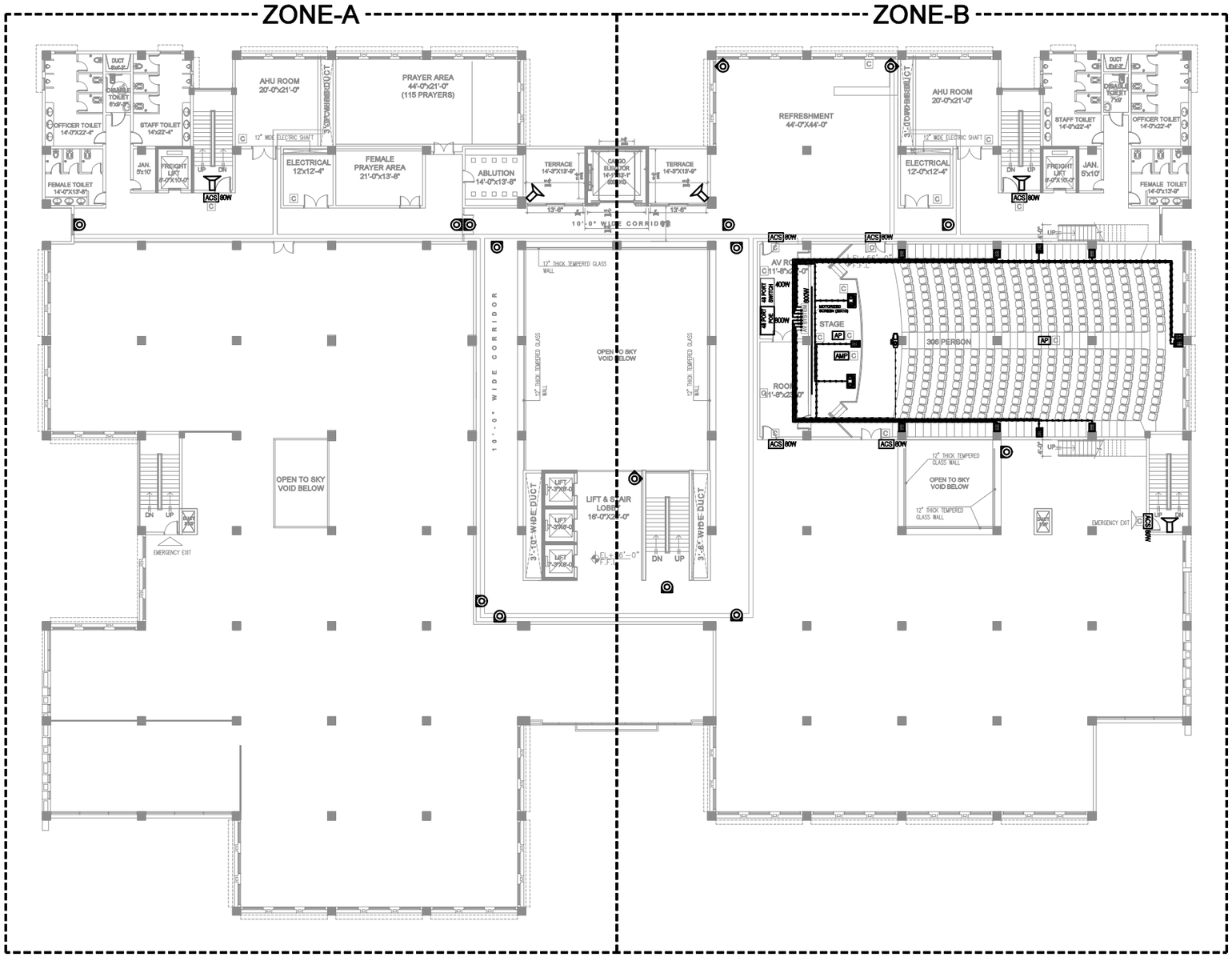
SCALE: 3/64"=1'-0"

DATE: APRIL, 2023

DRAWING No.: 4268/04/CD/1IT105

REV.: 0

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3/64"=1'-0" SHEET SIZE: A2



LEGEND:

SYMBOL	DESCRIPTION
C	COMPUTER NODE
	2MP FIXED LENS BULLET CAMERA
	4MP DOME CAMERA
48 PORT POE	48 PORT POE SWITCH
48 PORT SWITCH	48 PORT NON POE SWITCH
ACS	ACCESS CONTROL SYSTEM
AP	ACCESS POINT SYSTEM
AMP	AUDITORIUM MULTI MEDIA PROJECTOR
	WALL MOUNTED LOUD SPEAKER
	SUB WOOFER LOUD SPEAKER
	MONITOR LOUD SPEAKER
	8000 LUMENS BLAZER PROJECTOR
AV SYSTEM	AV SYSTEM
	UTP CABLE RUNNING IN CABLE TRAY FIBER CABLE RUNNING IN CABLE TRAY
OFC	PA,FA & OFC CABLES COMING FROM MAIN BUILDING

4TH FLOOR PLAN

CLIENT
HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
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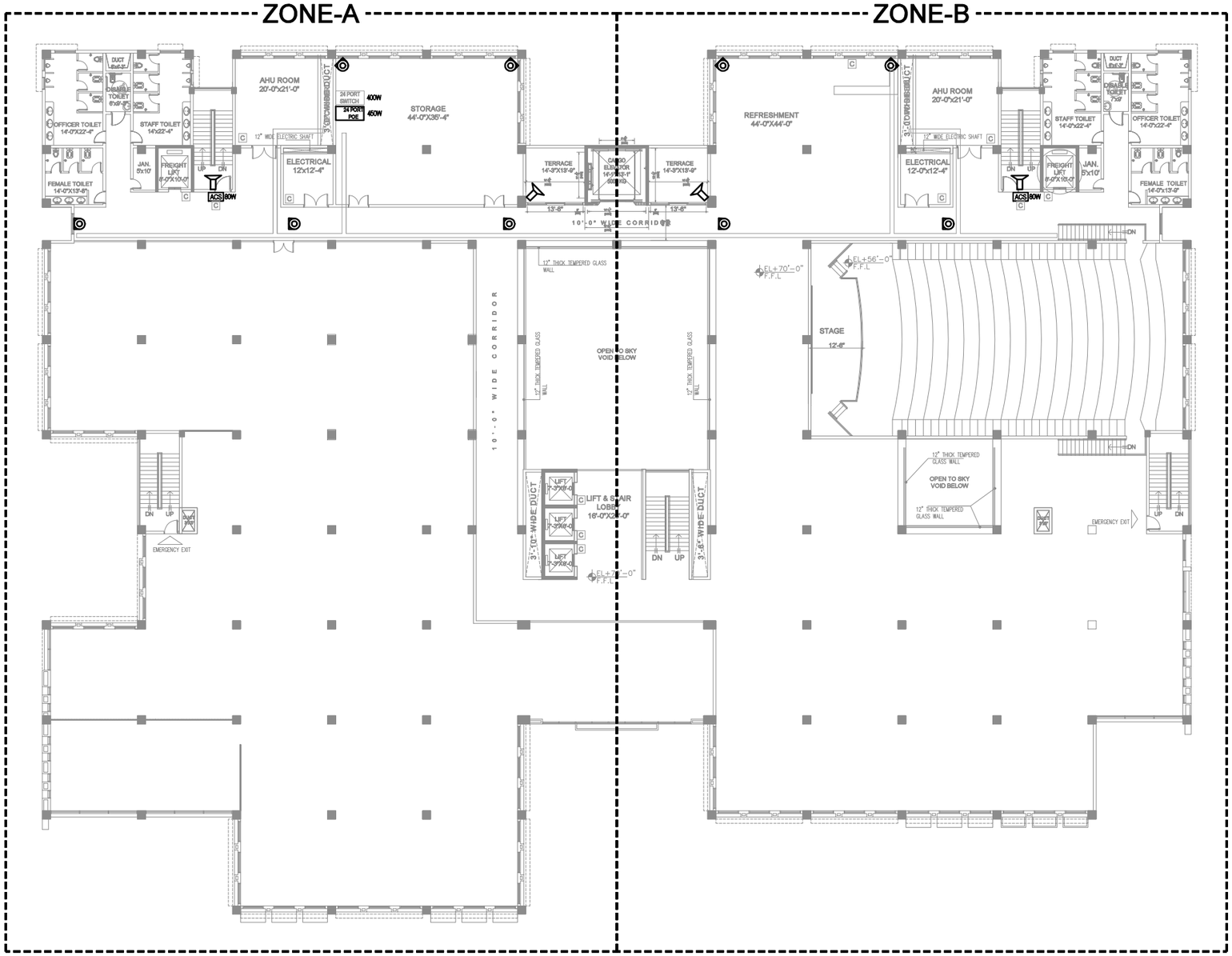
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APPROVED	

PROJECT
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
4th FLOOR PLAN
LOCAL AREA NETWORK, WIRELESS LOCAL AREA NETWORK, CCTV, ACCESS CONTROL & AUDITORIUM MULTI MEDIA PROJECTOR SYSTEMS LAYOUT

SCALE: 3/64"=1'-0"
DATE: APRIL, 2023
DRAWING No.: 4268/04/CD/1IT106
REV.: 0

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3/64"=1'-0" SHEET SIZE: A2



LEGEND:

SYMBOL	DESCRIPTION
C	COMPUTER NODE
	2MP FIXED LENS BULLET CAMERA
	4MP DOME CAMERA
24 PORT POE	24 PORT POE SWITCH
24 PORT SWITCH	24 PORT NON POE SWITCH
ACS	ACCESS CONTROL SYSTEM
	UTP CABLE RUNNING IN CABLE TRAY FIBER CABLE RUNNING IN CABLE TRAY
OFC	PA,FA & OFC CABLES COMING FROM MAIN BUILDING

5TH FLOOR PLAN

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
04			
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02			
01			

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SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
5th FLOOR PLAN
LOCAL AREA NETWORK, CCTV & ACCESS CONTROL SYSTEMS LAYOUT

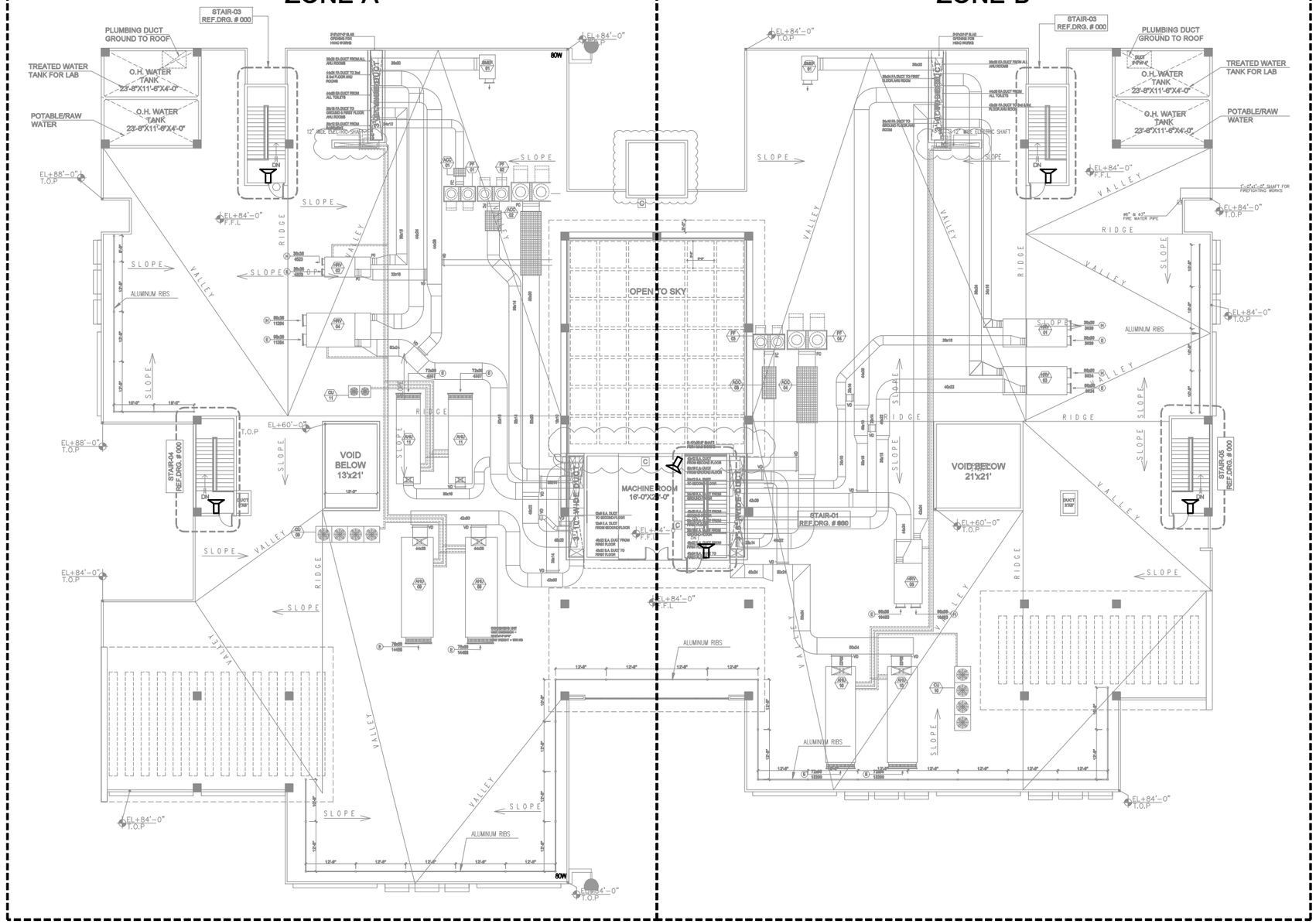
SCALE: 3/64"=1'-0"

DATE: APRIL, 2023

DRAWING No.: 4268/04/CD/1IT107

REV.: 0

E:\MAIN BUILDING.DWG
3/64"=1'-0" SHEET SIZE: A2



LEGEND:

SYMBOL	DESCRIPTION
C	COMPUTER NODE
	2MP FIXED LENS BULLET CAMERA
	PTZ CAMERA
	UTP CABLE RUNNING IN CABLE TRAY FIBER CABLE RUNNING IN CABLE TRAY
OFC	PA,FA & OFC CABLES COMING FROM MAIN BUILDING

ROOF FLOOR PLAN

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

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REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
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SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
ROOF PLAN
LOCAL AREA NETWORK & CCTV SYSTEMS LAYOUT

SCALE: 3/64"=1'-0"

DATE: APRIL, 2023

DRAWING No.: 4268/04/CD/1IT108

REV.: 0

E:\MAIN BUILDING.DWG
3/64"=1'-0" SHEET SIZE: A3

HOME DEPARTMENT
GOVERNMENT OF
SINDH

ESTABLISHMENT OF SINDH FORENSIC
SCIENCE LABORATORY KARACHI
MAIN BUILDING

COMMUNICATION WORKS

FIRE ALARM & PUBLIC ADRRESS SYSYTEM DRAWINGS
IT DRAWINGS

APRIL, 2025

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED
13th Floor, N.I.C. Building, Abbasi Shaheed Road, Off. Shahrah-e-Faisal, Karachi
PABX:+92-21-99090000 Fax : +92-21-35651994, 99225366
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LIST OF DRAWING

SR. #	DRAWING NO.	TITLE
		GENERAL DRAWINGS
1	4268/04/CD/E000	LIST OF DRAWING
2	4268/04/CD/E001	GENERAL NOTES
		SCHEMATIC DIAGRAMS
3	4268/04/CD/E002	ADDRESSABLE FIRE ALARM SYSTEM SCHEMATIC DIAGRAM
4	4268/04/CD/E003	PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC DIAGRAM
		PERIMETER INTRUSION DETECTION SYSTEM (PIDS)
5	4268/04/CD/E004	MASTER PLAN
		ADDRESSABLE FIRE ALARM SYSTEM LAYOUT DRAWINGS
6	4268/04/CD/1E101	MAIN BUILDING BASEMENT FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
7	4268/04/CD/1E102	MAIN BUILDING GROUND FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
8	4268/04/CD/1E103	MAIN BUILDING FIRST FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
9	4268/04/CD/1E104	MAIN BUILDING SECOND FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
10	4268/04/CD/1E105	MAIN BUILDING THIRD FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
11	4268/04/CD/1E106	MAIN BUILDING FOURTH FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
12	4268/04/CD/1E107	MAIN BUILDING FIFTH FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
13	4268/04/CD/1E108	MAIN BUILDING ROOF ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
14	4268/04/CD/2E201	EVIDENCE COLLECTION BLOCK BASEMENT FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
15	4268/04/CD/2E202	EVIDENCE COLLECTION BLOCK GROUND FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
16	4268/04/CD/2E203	EVIDENCE COLLECTION BLOCK FIRST FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
17	4268/04/CD/2E204	EVIDENCE COLLECTION BLOCK ROOF ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
18	4268/04/CD/3E301	RECEPTION BLOCK GROUND FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
19	4268/04/CD/3E302	RECEPTION BLOCK FIRST FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
20	4268/04/CD/3E303	RECEPTION BLOCK ROOF ADDRESSABLE FIRE ALARM SYSTEM LAYOUT

LIST OF DRAWING

		PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT DRAWINGS
21	4268/04/CD/1E107	MAIN BUILDING BASEMENT FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
22	4268/04/CD/1E108	MAIN BUILDING GROUND FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
23	4268/04/CD/1E109	MAIN BUILDING FIRST FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
24	4268/04/CD/1E110	MAIN BUILDING SECOND FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
25	4268/04/CD/1E111	MAIN BUILDING THIRD FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
26	4268/04/CD/1E112	MAIN BUILDING FOURTH FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
27	4268/04/CD/1E113	MAIN BUILDING FIFTH FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
28	4268/04/CD/1E114	MAIN BUILDING ROOF PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
29	4268/04/CD/2E205	EVIDENCE COLLECTION BLOCK BASEMENT FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
30	4268/04/CD/2E206	EVIDENCE COLLECTION BLOCK GROUND FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
31	4268/04/CD/2E207	EVIDENCE COLLECTION BLOCK FIRST FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
32	4268/04/CD/2E208	EVIDENCE COLLECTION BLOCK ROOF PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
33	4268/04/CD/3E304	RECEPTION BLOCK GROUND FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
34	4268/04/CD/3E305	RECEPTION BLOCK FIRST FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
35	4268/04/CD/3E306	RECEPTION BLOCK ROOF PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
		CCTV, LOCAL AREA NETWORK, WLAN, VIDEO CONFERENCE,EMPLOYEE ATTENDANCE, ACCESS CONTROL & WALK THROUGH GATE, UVSS, BAGGAGE SCANNING
36	4268/04/CD/1IT101	MAIN BUILDING BASEMENT FLOOR LOCAL AREA NETWORK,CCTV & ACCESS CONTROL SYSTEMS LAYOUT
37	4268/04/CD/1IT102	MAIN BUILDING GROUND FLOOR LOCAL AREA NETWORK, WIRELESS LOCAL AREA NETWORK, CCTV, MULTIMEDIA PROJECTOR, EMPLOYEE ATTENDANCE, WALK THROUGH GATE, VIDEO CONFERENCE, ACCESS CONTROL, BAGGAGE SCANNING MACHINE & MICROPHONE CONFERENCE SYSTEMS LAYOUT
38	4268/04/CD/1IT103	MAIN BUILDING FIRST FLOOR LOCAL AREA NETWORK, WIRELESS LOCAL AREA NETWORK, CCTV & ACCESS CONTROL SYSTEMS LAYOUT
39	4268/04/CD/1IT104	MAIN BUILDING SECOND FLOOR LOCAL AREA NETWORK, CCTV & ACCESS CONTROL SYSTEMS LAYOUT
40	4268/04/CD/1IT105	MAIN BUILDING THIRD FLOOR LOCAL AREA NETWORK, WIRELESS LOCAL AREA NETWORK, CCTV, MULTIMEDIA PROJECTOR & ACCESS CONTROL SYSTEMS LAYOUT
41	4268/04/CD/1IT106	MAIN BUILDING FOURTH FLOOR LOCAL AREA NETWORK, WIRELESS LOCAL AREA NETWORK, CCTV, ACCESS CONTROL, BAGGAGE SCANNING MACHINE & AUDITORIUM MULTI MEDIA PROJECTOR SYSTEMS LAYOUT
42	4268/04/CD/1IT107	MAIN BUILDING FIFTH FLOOR LOCAL AREA NETWORK, WIRELESS LOCAL AREA NETWORK, CCTV, ACCESS CONTROL, BAGGAGE SCANNING MACHINE & AUDITORIUM MULTI MEDIA PROJECTOR SYSTEMS LAYOUT
43	4268/04/CD/1IT108	MAIN BUILDING FIFTH FLOOR LOCAL AREA NETWORK, CCTV & ACCESS CONTROL SYSTEMS LAYOUT
44	4268/04/CD/1IT109	MAIN BUILDING ROOF LOCAL AREA NETWORK & CCTV SYSTEMS LAYOUT

CCTV, LOCAL AREA NETWORK & QUEUE MANAGEMENT

45	4268/04/CD/2IT107	EVIDENCE COLLECTION BLOCK BASEMENT FLOOR CCTV, LOCAL AREA NETWORK & QUEUE MANAGEMENT
46	4268/04/CD/2IT108	EVIDENCE COLLECTION BLOCK GROUND FLOOR CCTV, LOCAL AREA NETWORK & QUEUE MANAGEMENT
47	4268/04/CD/2IT109	EVIDENCE COLLECTION BLOCK FIRST FLOOR CCTV, LOCAL AREA NETWORK & QUEUE MANAGEMENT
48	4268/04/CD/2IT110	EVIDENCE COLLECTION BLOCK ROOF CCTV, LOCAL AREA NETWORK & QUEUE MANAGEMENT
		CCTV, LOCAL AREA NETWORK & QUEUE MANAGEMENT
49	4268/04/CD/3IT111	RECEPTION BLOCK GROUND FLOOR CCTV, LOCAL AREA NETWORK & QUEUE MANAGEMENT
50	4268/04/CD/3IT112	RECEPTION BLOCK GROUND FLOOR CCTV, LOCAL AREA NETWORK & QUEUE MANAGEMENT
51	4268/04/CD/3IT113	RECEPTION BLOCK GROUND FLOOR CCTV, LOCAL AREA NETWORK & QUEUE MANAGEMENT
		CCTV, UVSS, WALK THROUGH GATE, BAGGAGE SCANNING
52	4268/04/CD/4IT114	MASTER PLAN CCTV, UVSS, WALK THROUGH GATE, BAGGAGE SCANNING

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

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04				DRAWN
03				SUBMITTED
02				RECOMMENDED
01				CHD./VER.

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
LIST OF DRAWING

SCALE: NTS

DATE: APRIL, 2023

DRAWING No.: **4268/04/CD/ E000**

REV.: 0

E:\NAWAB\01_FAS,PAS,PIDS – (31-08-2022)_2 AZAM\FIRE ALAM\01_LIST OF DRAWINGS\01_LIST OF DRAWINGS.DWG

STD-A1-0 SHEET SIZE: A1

GENERAL NOTES:

1– THE WORD COMMUNICATION IN THESE DRAWINGS REFER TO FIRE ALARM, PUBLIC ADDRESS, AND PERIMETER INTRUSION DETECTION SYSTEM.

2– CO–ORDINATE AT SITE WITH OTHER SERVICES FOR EXACT LOCATION AND POSITION OF CONDUITS AND COMMUNICATION EQUIPMENT/DEVICES.

3– ALL COMMUNICATION DRAWINGS SHALL BE READ IN CONJUNCTION WITH SPECIFICATIONS, BOQ, ARCHITECTURE, ELECTRICAL, STRUCTURE, HVAC, PLUMBING DRAWINGS AND ALL OTHER RELEVANT DETAILS.

4– DIMENSIONS/MEASUREMENTS GIVEN IN LAYOUTS ARE APPROXIMATE. THE CONTRACTOR SHALL BE RESPONSIBLE TO CALCULATE ACTUAL DIMENSIONS/MEASUREMENTS ACCORDING TO STRUCTURE AND ARCHITECTURE DRAWINGS.

5– THE ROUTES OF EXTERNAL CABLE AND PIPES SHALL BE FOLLOWED AS SHOWN ON THE DRAWING, ANY CHANGE IN ROUTES REQUIRED DUE TO SITE CONDITIONS SHALL BE MADE IN CO–ORDINATION WITH OTHER SERVICES, AFTER OBTAINING ENGINEER'S APPROVAL

6– WHERE CABLES ENTER BUILDINGS, THESE SHALL BE LAID IN PROTECTIVE PIPES. HAND HOLE SHALL BE PROVIDED OUTSIDE THE BUILDING.

7– ALL UNDERGROUND PIPES SHALL BE LAID MINIMUM 1.5 FEET BELOW THE TOP OF PAVEMENT THE DEPTH MAY BE INCREASED / DECREASED DUE TO THE SITE CONDITIONS AFTER OBTAINING ENGINEERS APPROVAL

8– ALL UNDERGROUND PIPES, MAN HOLES & HANDHOLES SHALL BE PROPERLY SEALED WATER TIGHT AT ENDS/JOINTS AFTER INSTALLATION.

9– SPARE PIPES SHALL HAVE THEIR ENDS PROPERLY PLUGGED WITH CAP AND MADE WATER TIGHT. BOTH ENDS OF PIPES SHALL BE MARKED BY PIPE END MARKERS FOR IDENTIFICATION.

10– CABLE MARKERS SHALL BE PROVIDED AT 30 METER INTERVALS ALONG STRAIGHT RUNS OF CABLE DUCT / ROUTE AND AT EACH BEND.

11– ALL ROUTING OF PIPES, PIPE DUCTS & CONNECTION DETAILS SHALL BE CARRIED OUT WITH THE APPROVAL OF THE ENGINEER.

12– MANUFACTURER'S RECOMMENDATION SHALL BE FOLLOWED FOR INSTALLATION OF ALL COMMUNICATION SYSTEMS.

13– THE CONTRACTOR SHALL TAKE THE RESPONSIBILITIES OF GENERAL INTEGRATOR FOR ALL THE SUB–SYSTEMS AND EQUIPMENT WITHIN THE SCOPE OF WORK INCLUDING INTERFACES WITH OTHER SYSTEMS.

14– ALL COMMUNICATION SYSTEMS SHALL BE FED FROM UNINTERRUPTED POWER SUPPLY (UPS).

15– MOUNTING HEIGHT OF FOLLOWING DEVICES SHALL BE INSTALLED AT THE INDICATED HEIGHT FROM FINISHED FLOOR LEVEL (F.F.L) TO THE BOTTOM OF DEVICE UNLESS

- ADDRESSABLE FIRE ALARM CONTROL PANEL ---------- 56INCH
- ADDRESSABLE CONTROL/MONITOR MODULE ---------- 87INCH / AS PER SITE
- ADDRESSABLE MANUAL CALL POINT ---------- 56INCH
- ADDRESSABLE BEAM DETECTOR ---------- 1008INCH / AS PER SITE
- ADDRESSABLE SOUNDER ---------- 87INCH / AS PER SITE
- HORN SPEAKER ---------- 156INCH / AS PER SITE
- MICRO PHONE SOCKET OUTLET ---------- 10INCH / AS PER SITE
- WEATHER PROOF ENCLOSURE ---------- AS PER SITE

16– COLOUR, SHAPE & MOUNTING HEIGHT OF MICROPHONE SOCKET OUTLETS SHALL MATCH WITH ELECTRICAL AND TELECOMMUNICATION SOCKET OUTLET

17– DETECTORS SHALL BE INSTALLED 1 FEET AWAY FROM ANY PART OF ANY LIGHT FIXTURE AND 3 FEET AWAY FROM DIFFUSER OF HVAC SYSTEM.

18– WHERE MANUAL CALL POINT AND SOUNDER ARE SHOWN SIDE BY SIDE THEY SHALL BE INSTALLED IN SAME VERTICAL LINE.

19– CONTRACTOR SHALL SUBMIT SOUND PRESSURE LEVEL (SPL) CALCULATION OF SPEAKERS ON THE LAYOUT DRAWINGS OF SINDH FORENRIC SCIENCE LAB FOR REVIEW AND APPROVAL OF ENGINEER.

20– IN PARKING AREA HORN SPEAKERS SHALL BE PLACED ON THE WALL/COLUMN AS PER SITE.

21– CONTRACTOR SHALL SUBMIT CO–ORDINATION SHOP DRAWING OF COMMUNICATION SYSTEM LAYOUT WITH POWER LAYOUT BEFORE EXECUTION OF WORKS.

22– CONTRACTOR SHALL CO–ORDINATE WITH HVAC LAYOUT FOR PLACEMENT OF RACKS IN COMMAND AND CONTROL ROOM/COMMUNICATION EQUIPMENT ROOM.

23– CONTRACTOR SHALL CO–ORDINATE WITH FIRE FIGHTING LAYOUT FOR PLACEMENT OF MONITOR MODULE IN DATA CENTER.

CABLE SCHEDULE

A– 2 CORE 1.5 Sq.mm (120 min) FIRE RESISTANT ENHANCED
LSZH CABLE COMPLYING BS 5839, BS 6387, EN50200.
BS 8434–2:2003 + A2:200 / MANUFACTURER'S RECOMMENDED CABLE

B– 2 CORE 2.5 Sq.mm (120 min) FIRE RESISTANT ENHANCED
LSZH CABLE COMPLYING BS 5839, BS 6387,
EN50200, BS 8434–2:2003 + A2:200 CABLE
/ MANUFACTURER'S RECOMMENDED CABLE

C– MANUFACTURER'S RECOMMENDED CABLE

CLIENT	CONSULTANT			PROJECT	
HOME DEPARTMENT, GOVERNMENT OF SINDH	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.	04		DRAWN	
	ARCHITECTURE & PLANNING DIVISION KARACHI. 4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99205430–34	03		SUBMITTED	
		02		RECOMMENDED	
		01		CHD./VER.	
		REV.	DATE	DESCRIPTION	APPROVED

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
BASEMENT FLOOR

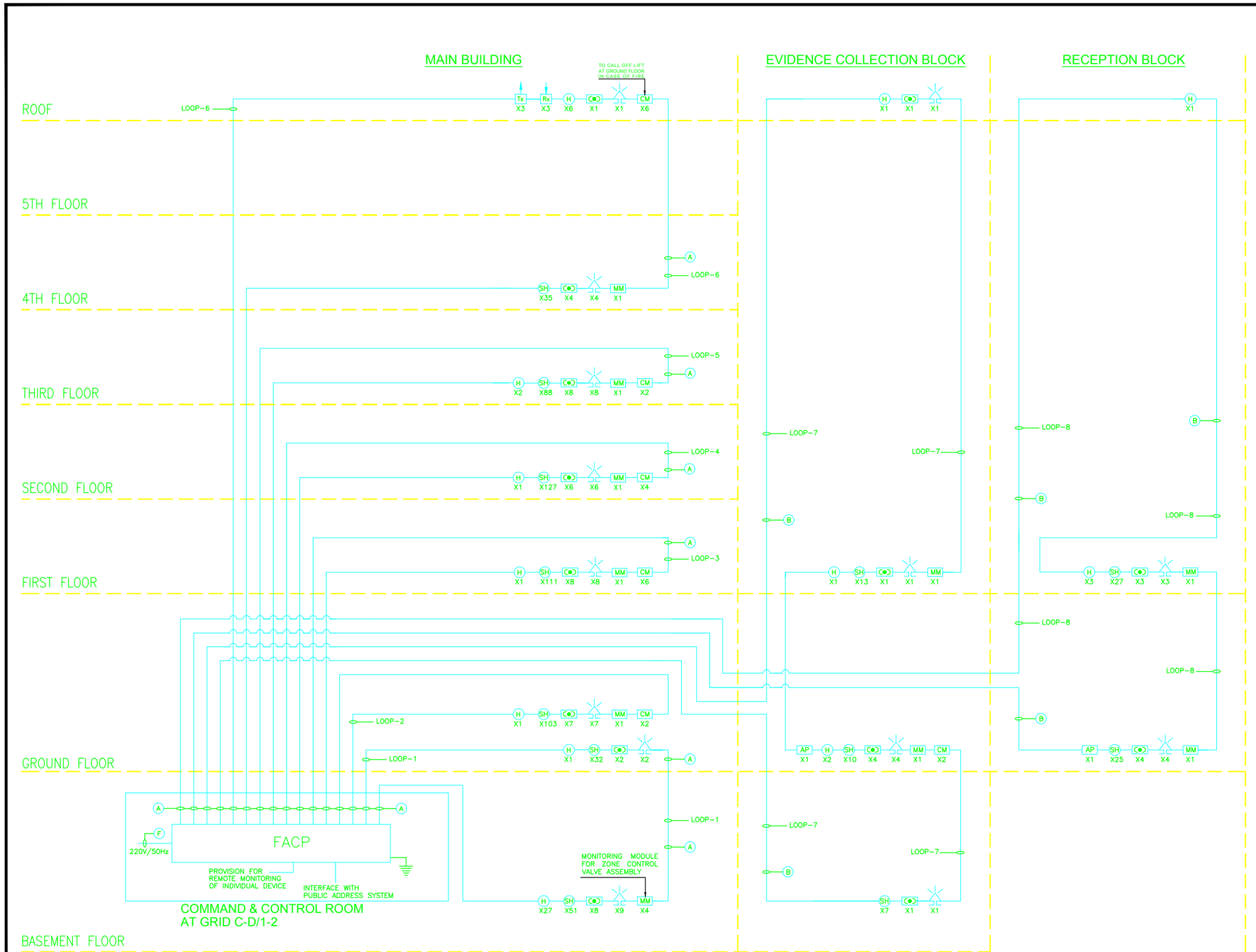
SCALE: NTS

DATE: APRIL, 2023

DRAWING No.: 4268/04/CD/ E001

REV.: 0

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NOTES:-

1. FOR LEGEND REFER LAYOUT DRAWINGS.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/CD/E001
3. FOR EXTERNAL CONNECTIVITY OF FIRE ALARM NETWORK LAYOUT REFER DRAWING NO. 4268/04/CD/4IT114

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CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
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REV.	DATE	DESCRIPTION	APPROVED
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CHD./VER.	
APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
SCHEMATIC DIAGRAM

SCALE: NTS

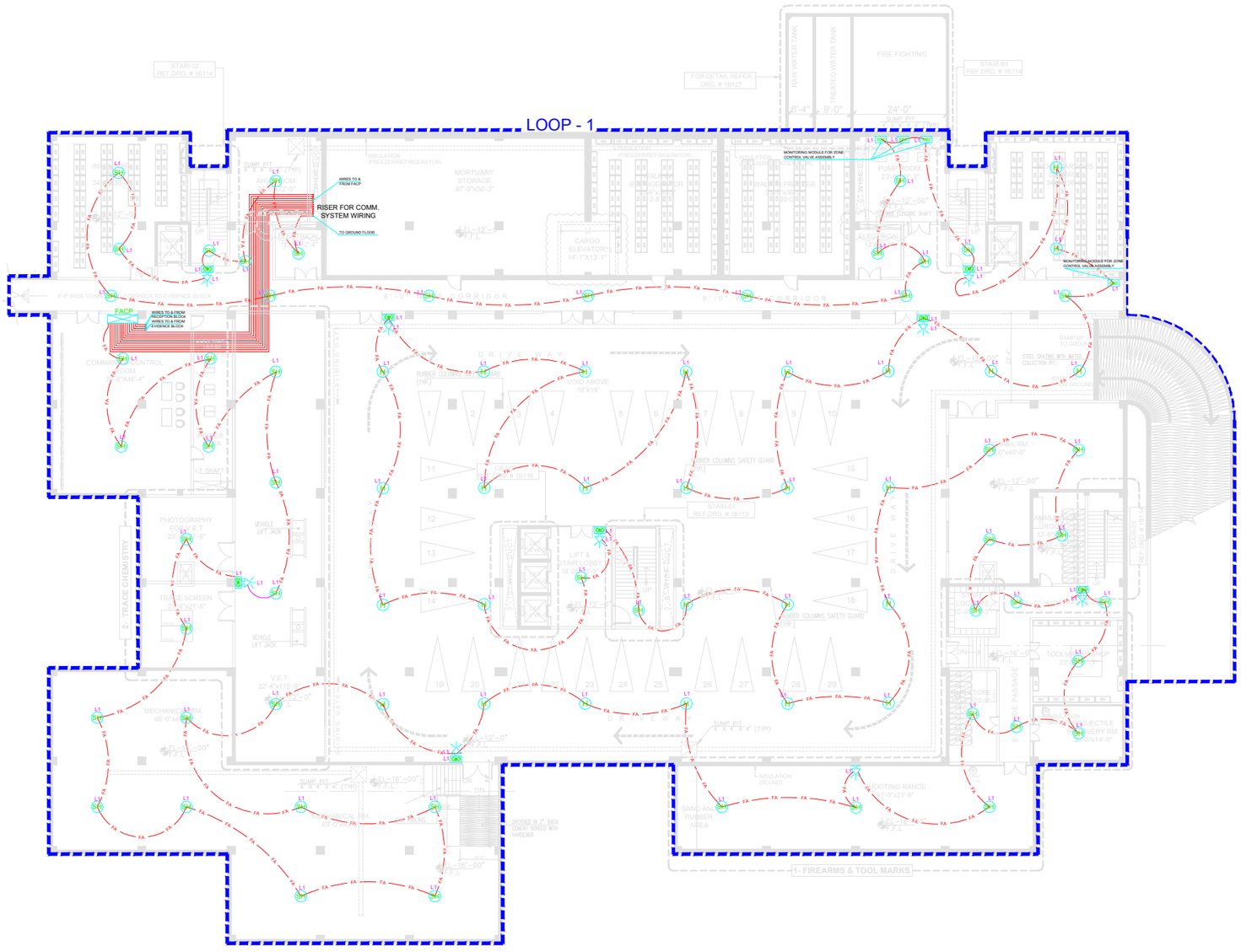
DATE: APRIL, 2023

DRAWING No.: **4268/04/CD/ E002**

REV.: 0

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3/64"=1'-0" SHEET SIZE: A2





NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/C/E001
3. FOR ADDRESSABLE FIRE ALARM SYSTEM SCHEMATIC DIAGRAM REFER DRAWING NO. 4268/04/CD/E002

LEGEND:-

SYMBOL	DESCRIPTION
SH	INTELLIGENT ADDRESSABLE LOOP POWERED OPTICAL SMOKE & HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
H	INTELLIGENT ADDRESSABLE LOOP POWERED HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
Tx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (TRANSMITTER)
Rx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (RECEIVER)
	ADDRESSABLE LOOP POWERED MANUAL CALL POINT WITH BASE & BUILT-IN ISOLATOR.
	ADDRESSABLE LOOP POWERED AUDIO VISUAL SOUNDER WITH BASE BUILT-IN ISOLATOR.
CM	ADDRESSABLE LOOP POWERED CONTROL/OUTPUT MODULE
MM	ADDRESSABLE LOOP POWERED MONITOR/INPUT MODULE
FACP	INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL WITH BACKUP BATTERIES, BATTERIES CHARGER & NETWORK CARD COMPLETE IN ALL RESPECT
AP	ADRESSABLE FIRE ALARM REPEATER/ANNUNCIATION PANEL INCLUDING ALL MOUNTING AND INSTALLATION ACCESSORIES.

BASMENT FLOOR PLAN

CLIENT
HOME DEPARTMENT,
GOVERNMENT OF SINDH

CONSULTANT
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
ARCHITECTURE & PLANNING DIVISION KARACHI.
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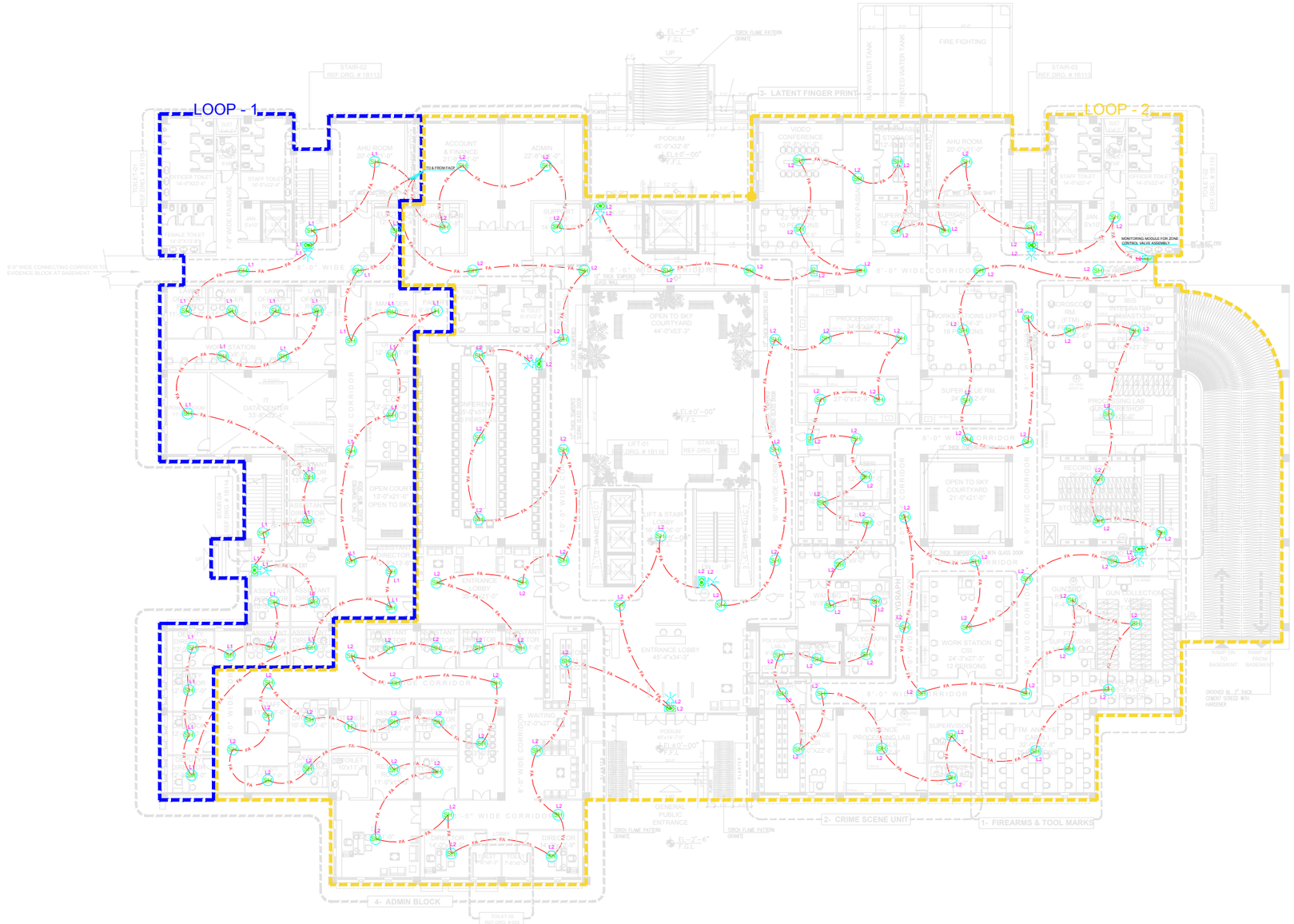
REV.	DATE	DESCRIPTION	APPROVED	APPROVED
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02				RECOMMENDED
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PROJECT
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
BASEMENT FLOOR

DATE: APRIL, 2023
DRAWING No.: 4268/04/CD/ 1E101
SCALE: 3/64"=1'-0"
REV.: 0

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NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/C/E001
3. FOR ADDRESSABLE FIRE ALARM SYSTEM SCHEMATIC DIAGRAM REFER DRAWING NO. 4268/04/CD/E002

LEGEND:-

SYMBOL	DESCRIPTION
SH	INTELLIGENT ADDRESSABLE LOOP POWERED OPTICAL SMOKE & HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
H	INTELLIGENT ADDRESSABLE LOOP POWERED HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
Tx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (TRANSMITTER)
Rx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (RECEIVER)
	ADDRESSABLE LOOP POWERED MANUAL CALL POINT WITH BASE & BUILT-IN ISOLATOR.
	ADDRESSABLE LOOP POWERED AUDIO VISUAL SOUNDER WITH BASE BUILT-IN ISOLATOR.
CM	ADDRESSABLE LOOP POWERED CONTROL/OUTPUT MODULE
MM	ADDRESSABLE LOOP POWERED MONITOR/INPUT MODULE
FACP	INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL WITH BACKUP BATTERIES, BATTERIES CHARGER & NETWORK CARD COMPLETE IN ALL RESPECT
AP	ADRESSABLE FIRE ALARM REPEATER/ANNUNCIATION PANEL INCLUDING ALL MOUNTING AND INSTALLATION ACCESSORIES.

GROUND FLOOR PLAN

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

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REV.	DATE	DESCRIPTION	APPROVED
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APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING GROUND FLOOR

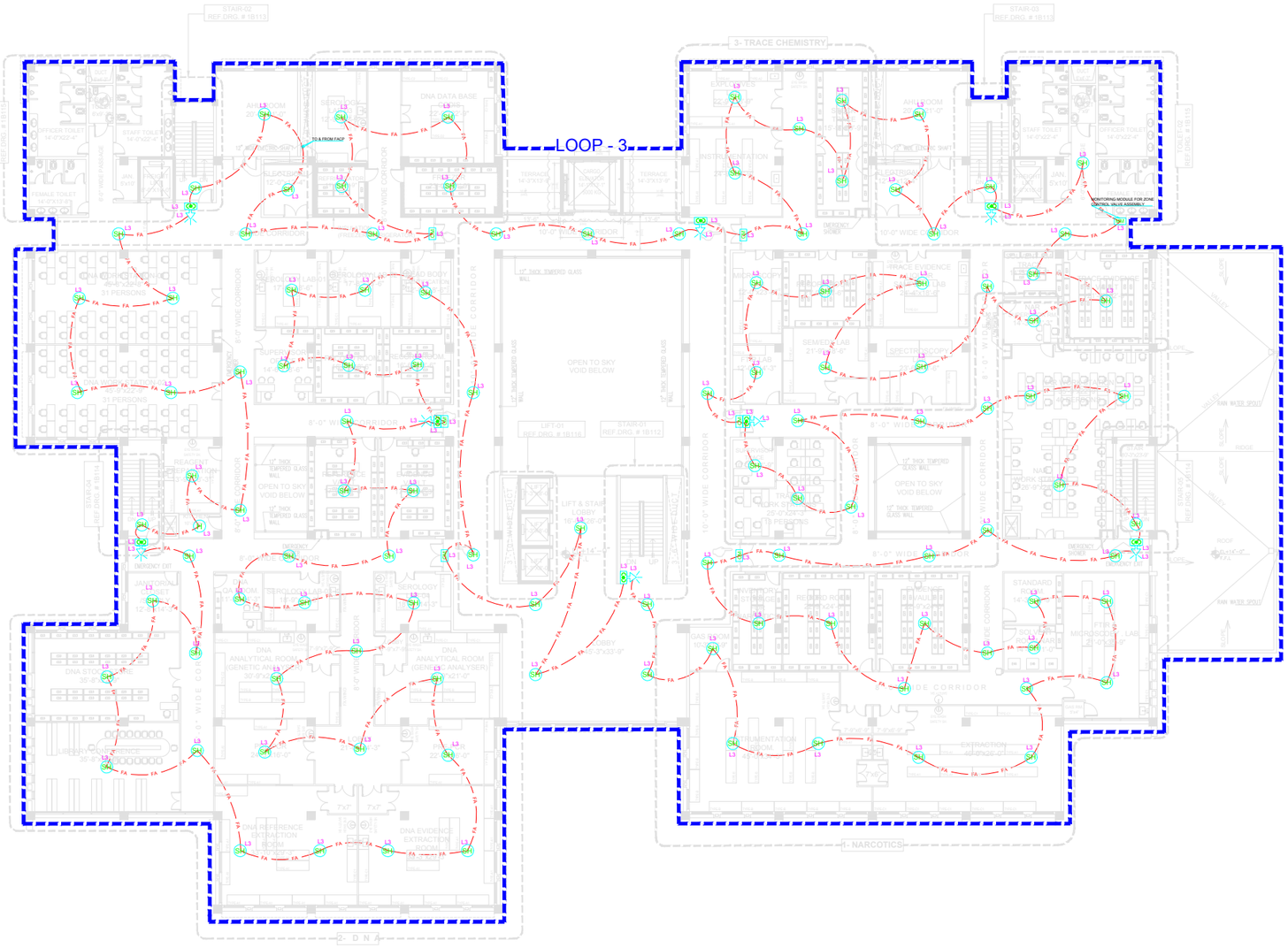
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DATE: APRIL, 2023

DRAWING No.: **4268/04/CD/ 1E102**

REV.: 0

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NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/C/E001
3. FOR ADDRESSABLE FIRE ALARM SYSTEM SCHEMATIC DIAGRAM REFER DRAWING NO. 4268/04/CD/E002

LEGEND:-

SYMBOL	DESCRIPTION
SH	INTELLIGENT ADDRESSABLE LOOP POWERED OPTICAL SMOKE & HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
H	INTELLIGENT ADDRESSABLE LOOP POWERED HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
Tx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (TRANSMITTER)
Rx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (RECEIVER)
	ADDRESSABLE LOOP POWERED MANUAL CALL POINT WITH BASE & BUILT-IN ISOLATOR.
	ADDRESSABLE LOOP POWERED AUDIO VISUAL SOUNDER WITH BASE BUILT-IN ISOLATOR.
CM	ADDRESSABLE LOOP POWERED CONTROL/OUTPUT MODULE
MM	ADDRESSABLE LOOP POWERED MONITOR/INPUT MODULE
FACP	INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL WITH BACKUP BATTERIES, BATTERIES CHARGER & NETWORK CARD COMPLETE IN ALL RESPECT
AP	ADRESSABLE FIRE ALARM REPEATER/ANNUNCIATION PANEL INCLUDING ALL MOUNTING AND INSTALLATION ACCESSORIES.

1ST FLOOR PLAN

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED	APPROVED
04				DRAWN
03				SUBMITTED
02				RECOMMENDED
01				CHD./VER.

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING FIRST FLOOR

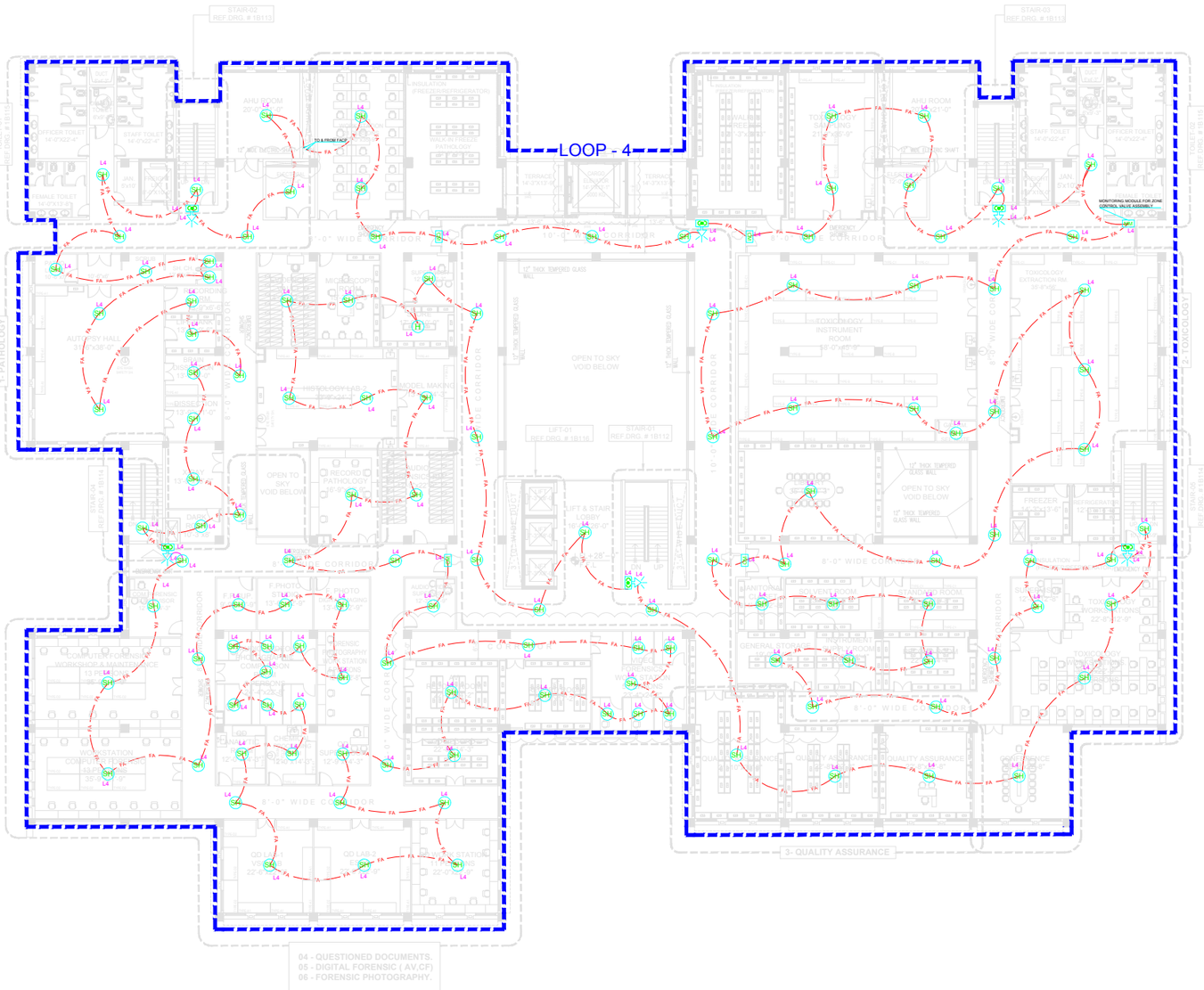
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DATE APRIL, 2023

DRAWING No. **4268/04/CD/ 1E103**

REV. 0

E:\NAWAB\01_FAS,PAS,PIDS – (31-08-2022)_2 AZAM\FIRE ALAM\03_FAS\02_MAIN BUILDING\1-MAIN BUILDING ARCHITETURE-10-05-2023\1-MAIN BUILDING ARCHITETURE-10-05-2023\FLOOR PLAN FINAL – COPY.DWG



2ND FLOOR PLAN

W
S
N
E

NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/C/E001
3. FOR ADDRESSABLE FIRE ALARM SYSTEM SCHEMATIC DIAGRAM REFER DRAWING NO. 4268/04/CD/E002

LEGEND:-

SYMBOL	DESCRIPTION
SH	INTELLIGENT ADDRESSABLE LOOP POWERED OPTICAL SMOKE & HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
H	INTELLIGENT ADDRESSABLE LOOP POWERED HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
TX	ADDRESSABLE LOOP POWERED BEAM DETECTOR (TRANSMITTER)
RX	ADDRESSABLE LOOP POWERED BEAM DETECTOR (RECEIVER)
	ADDRESSABLE LOOP POWERED MANUAL CALL POINT WITH BASE & BUILT-IN ISOLATOR.
	ADDRESSABLE LOOP POWERED AUDIO VISUAL SOUNDER WITH BASE BUILT-IN ISOLATOR.
CM	ADDRESSABLE LOOP POWERED CONTROL/OUTPUT MODULE
MM	ADDRESSABLE LOOP POWERED MONITOR/INPUT MODULE
FACP	INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL WITH BACKUP BATTERIES, BATTERIES CHARGER & NETWORK CARD COMPLETE IN ALL RESPECT
AP	ADRESSABLE FIRE ALARM REPEATER/ANNUNCIATION PANEL INCLUDING ALL MOUNTING AND INSTALLATION ACCESSORIES.

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
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SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
SECOND FLOOR

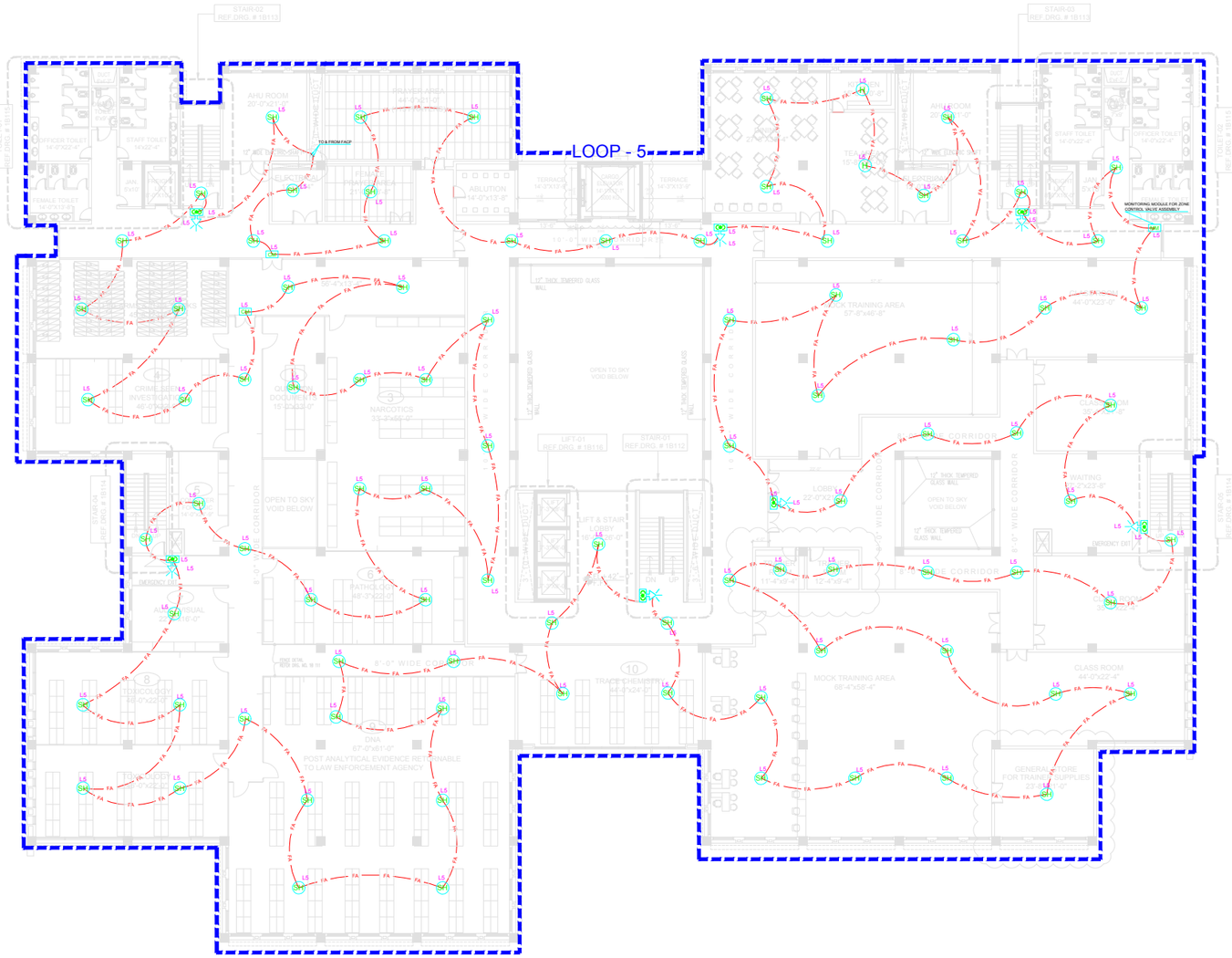
SCALE: 3/64"=1'-0"

DATE: APRIL, 2023

DRAWING No.: **4268/04/CD/ 1E104**

REV.: 0

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NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/C/E001
3. FOR ADDRESSABLE FIRE ALARM SYSTEM SCHEMATIC DIAGRAM REFER DRAWING NO. 4268/04/CD/E002

LEGEND:-

SYMBOL	DESCRIPTION
SH	INTELLIGENT ADDRESSABLE LOOP POWERED OPTICAL SMOKE & HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
H	INTELLIGENT ADDRESSABLE LOOP POWERED HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
Tx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (TRANSMITTER)
Rx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (RECEIVER)
	ADDRESSABLE LOOP POWERED MANUAL CALL POINT WITH BASE & BUILT-IN ISOLATOR.
	ADDRESSABLE LOOP POWERED AUDIO VISUAL SOUNDER WITH BASE BUILT-IN ISOLATOR.
CM	ADDRESSABLE LOOP POWERED CONTROL/OUTPUT MODULE
MM	ADDRESSABLE LOOP POWERED MONITOR/INPUT MODULE
FACP	INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL WITH BACKUP BATTERIES, BATTERIES CHARGER & NETWORK CARD COMPLETE IN ALL RESPECT
AP	ADRESSABLE FIRE ALARM REPEATER/ANNUNCIATION PANEL INCLUDING ALL MOUNTING AND INSTALLATION ACCESSORIES.

3RD FLOOR PLAN

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
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01			

DRAWN	
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
THIRD FLOOR

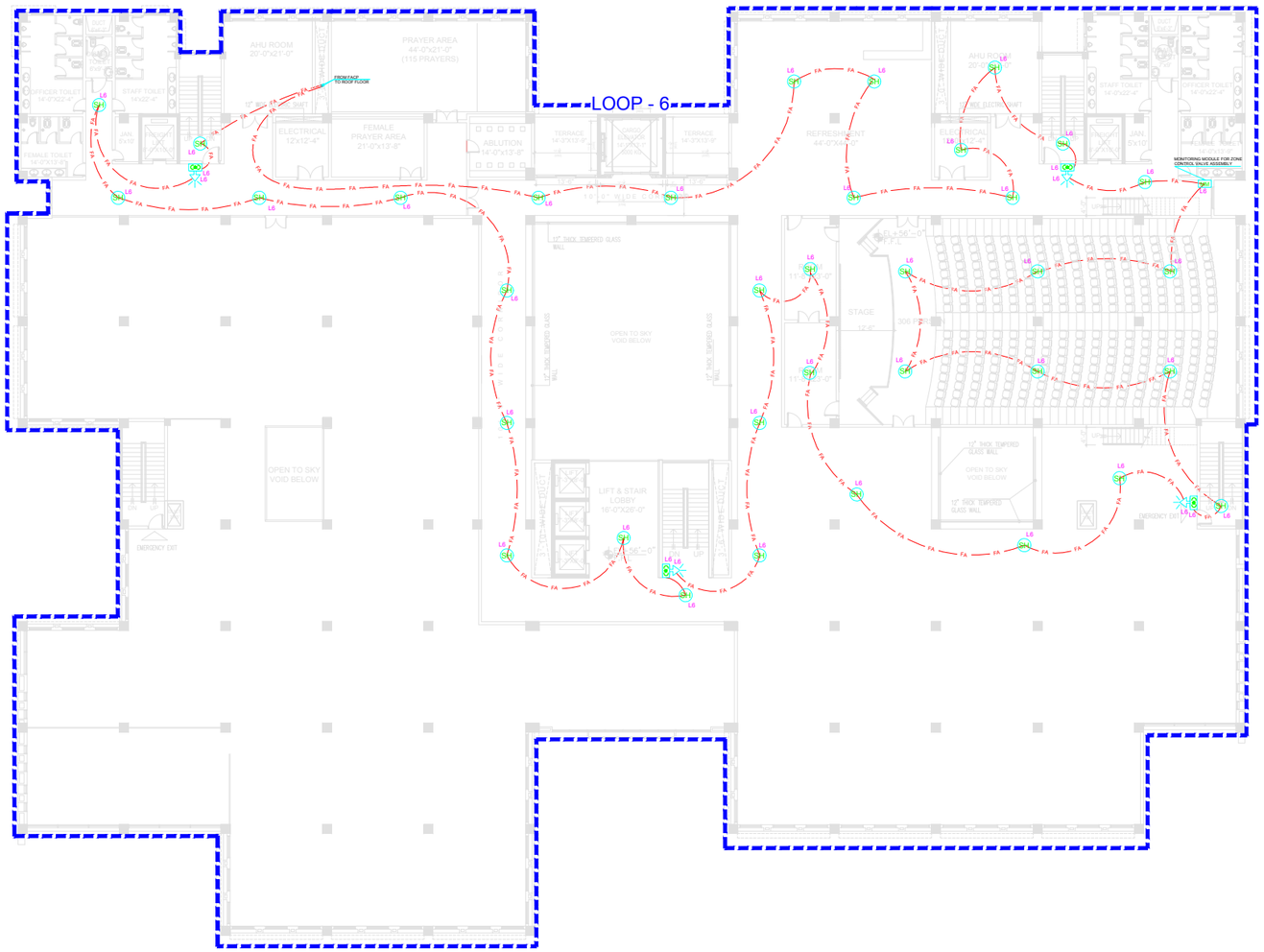
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DATE: APRIL, 2023

DRAWING No.: **4268/04/CD/ 1E105**

REV.: 0

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4TH FLOOR PLAN

NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/C/E001
3. FOR ADDRESSABLE FIRE ALARM SYSTEM SCHEMATIC DIAGRAM REFER DRAWING NO. 4268/04/CD/E002

LEGEND:-

SYMBOL	DESCRIPTION
SH	INTELLIGENT ADDRESSABLE LOOP POWERED OPTICAL SMOKE & HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
H	INTELLIGENT ADDRESSABLE LOOP POWERED HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
Tx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (TRANSMITTER)
Rx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (RECEIVER)
	ADDRESSABLE LOOP POWERED MANUAL CALL POINT WITH BASE & BUILT-IN ISOLATOR.
	ADDRESSABLE LOOP POWERED AUDIO VISUAL SOUNDER WITH BASE BUILT-IN ISOLATOR.
CM	ADDRESSABLE LOOP POWERED CONTROL/OUTPUT MODULE
MM	ADDRESSABLE LOOP POWERED MONITOR/INPUT MODULE
FACP	INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL WITH BACKUP BATTERIES, BATTERIES CHARGER & NETWORK CARD COMPLETE IN ALL RESPECT
AP	ADRESSABLE FIRE ALARM REPEATER/ANNUNCIATION PANEL INCLUDING ALL MOUNTING AND INSTALLATION ACCESSORIES.

CLIENT
HOME DEPARTMENT,
GOVERNMENT OF SINDH

CONSULTANT
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
4th FLOOR

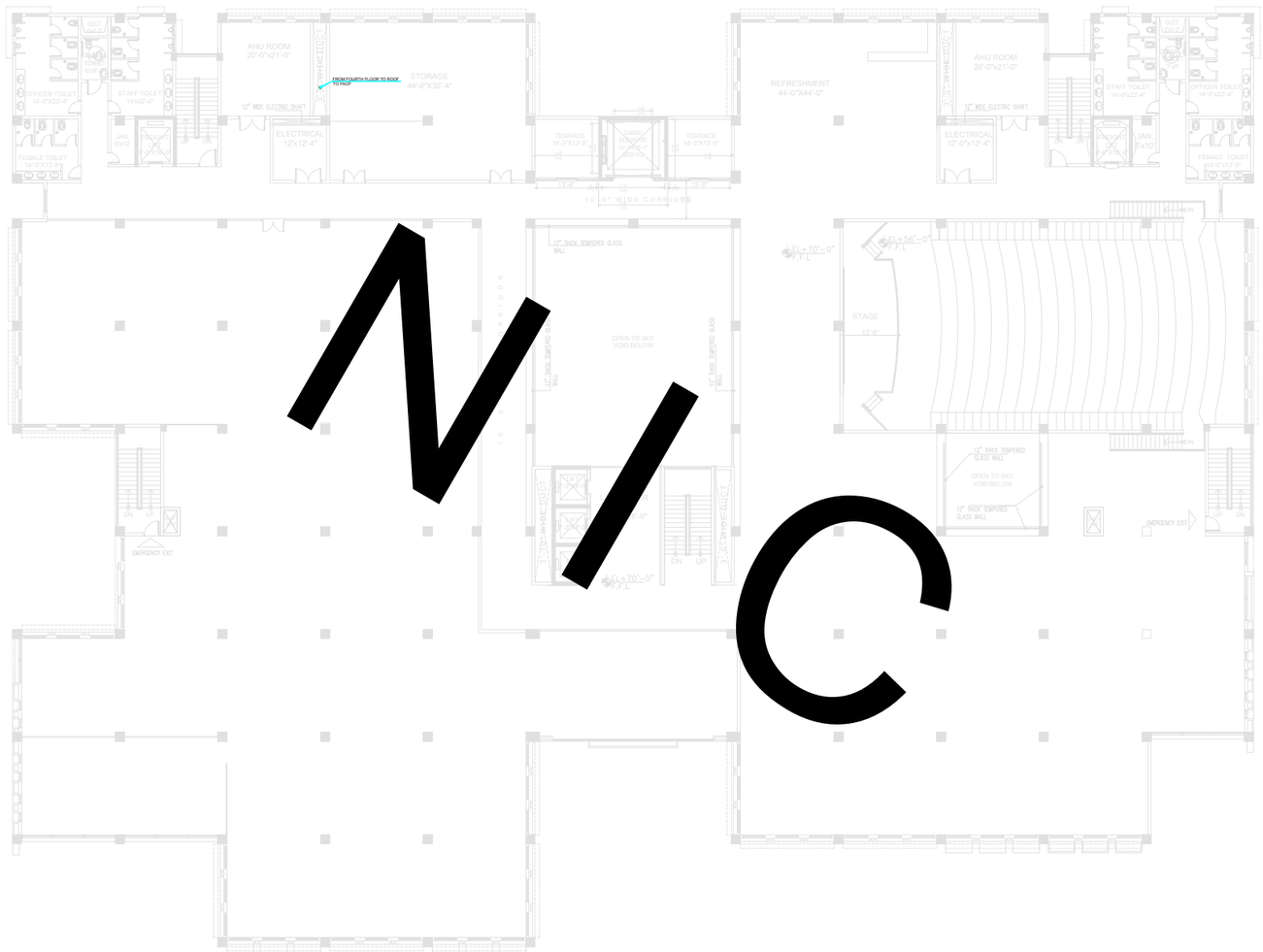
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DATE APRIL, 2023

DRAWING No. 4268/04/CD/ 1E106

REV. 0

E:\NAWAB\01_FAS,PAS,PIDS – (31-08-2022)_2 AZAM\FIRE ALAM\03_FAS\02_MAIN BUILDING\1-MAIN BUILDING ARCHITETURE-10-05-2023\1-MAIN BUILDING ARCHITETURE-10-05-2023\FLOOR PLAN FINAL – COPY.DWG

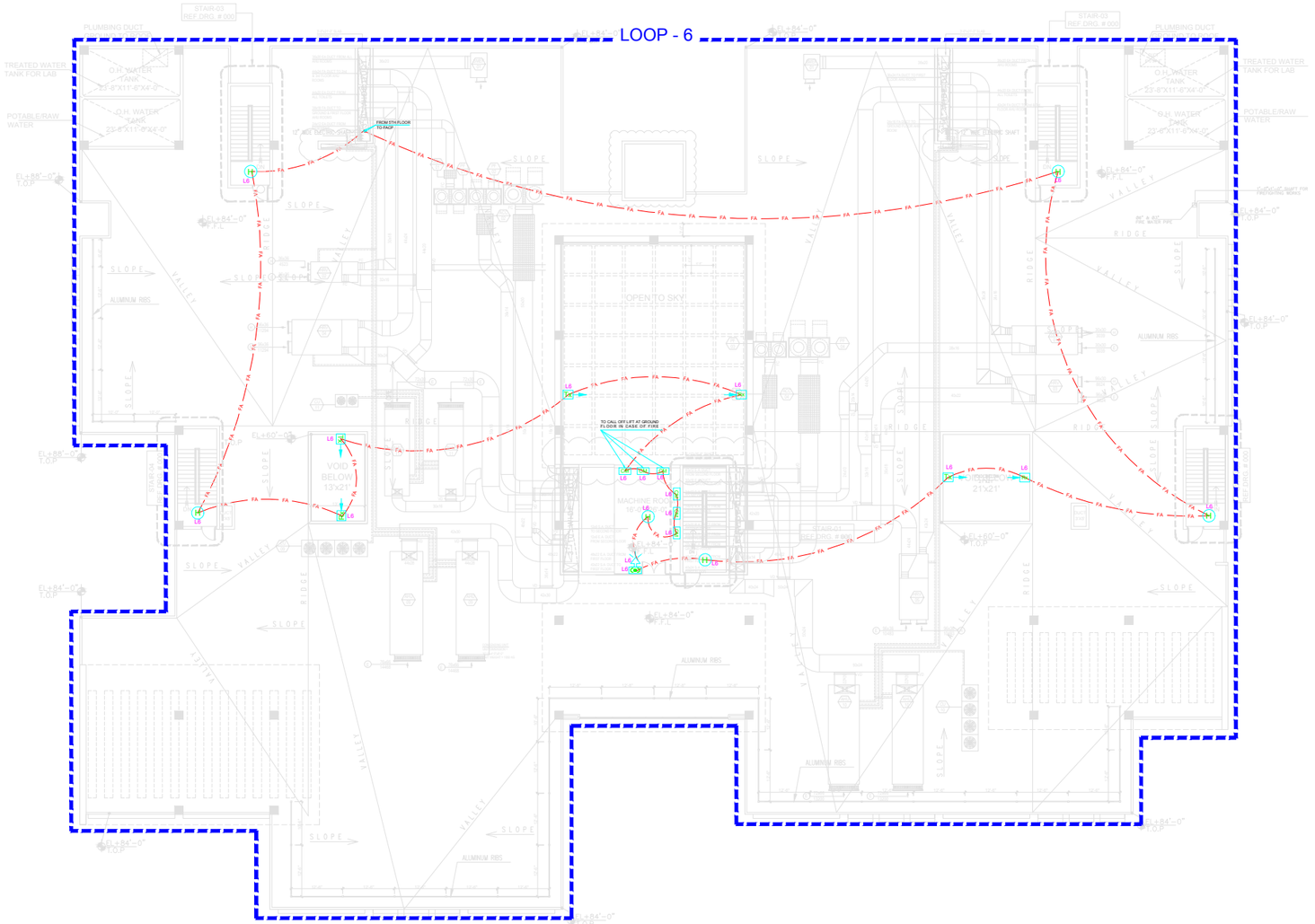


5TH FLOOR PLAN

CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH	CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. ARCHITECTURE & PLANNING DIVISION KARACHI. 4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34	04 / 03 / 02 / 01	DRAWN / SUBMITTED / RECOMMENDED / CHD./VER. / APPROVED	PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI	MAIN BUILDING 5th FLOOR; DATE: APRIL, 2023; DRAWING No.: 4268/04/CD/ 1E107; SCALE: 3/64"=1'-0"; REV.: 0

REV.	DATE	DESCRIPTION	APPROVED

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NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/C/E001
3. FOR ADDRESSABLE FIRE ALARM SYSTEM SCHEMATIC DIAGRAM REFER DRAWING NO. 4268/04/CD/E002
4. BEAM DETECTORS SHALL BE MOUNTED IN SUCH A WAY THAT LINE OF SIGHT FROM TRANSMITTER TO RECEIVER SHALL BE CLEAR OF ANY OBSTRUCTION AT ALL TIME.

LEGEND:-

SYMBOL	DESCRIPTION
SH	INTELLIGENT ADDRESSABLE LOOP POWERED OPTICAL SMOKE & HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
H	INTELLIGENT ADDRESSABLE LOOP POWERED HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
Tx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (TRANSMITTER)
Rx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (RECEIVER)
	ADDRESSABLE LOOP POWERED MANUAL CALL POINT WITH BASE & BUILT-IN ISOLATOR.
	ADDRESSABLE LOOP POWERED AUDIO VISUAL SOUNDER WITH BASE BUILT-IN ISOLATOR.
CM	ADDRESSABLE LOOP POWERED CONTROL/OUTPUT MODULE
MM	ADDRESSABLE LOOP POWERED MONITOR/INPUT MODULE
FACP	INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL WITH BACKUP BATTERIES, BATTERIES CHARGER & NETWORK CARD COMPLETE IN ALL RESPECT
AP	ADRESSABLE FIRE ALARM REPEATER/ANNUNCIATION PANEL INCLUDING ALL MOUNTING AND INSTALLATION ACCESSORIES.

ROOF FLOOR PLAN

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED	APPROVED
04				DRAWN
03				SUBMITTED
02				RECOMMENDED
01				CHD./VER.

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
ROOF FLOOR

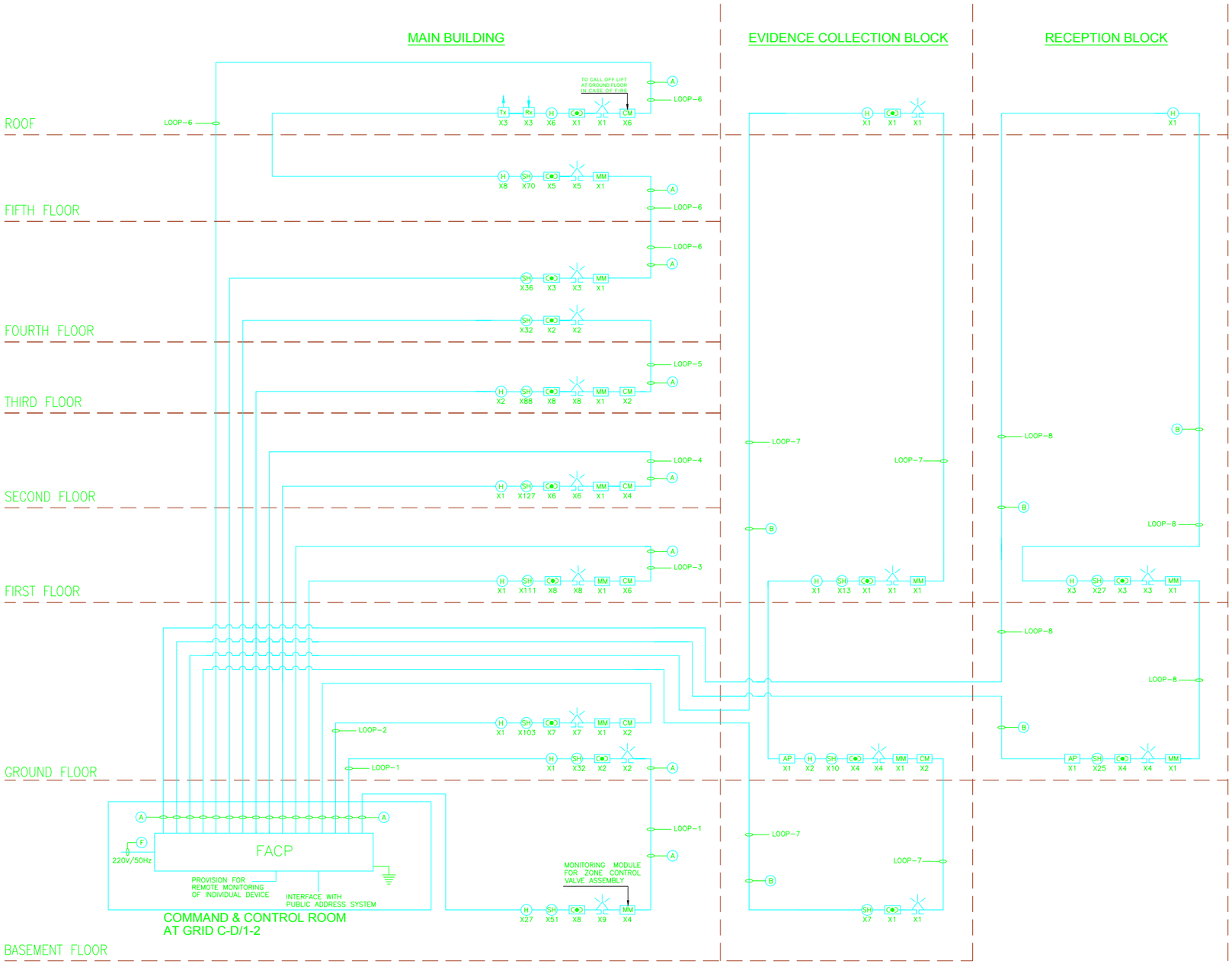
SCALE: 3/64"=1'-0"

DATE: APRIL, 2023

DRAWING No.: **4268/04/CD/ 1E108**

REV.: 0

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NOTES:-

1. FOR LEGEND REFER LAYOUT DRAWINGS.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/CD/E001
3. FOR EXTERNAL CONNECTIVITY OF FIRE ALARM NETWORK LAYOUT REFER DRAWING NO. 4268/04/CD/4IT114

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
04			DRAWN
03			SUBMITTED
02			RECOMMENDED
01			CHD./VER.
			APPROVED

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
SCHEMATIC DIAGRAM

DATE: APRIL, 2024

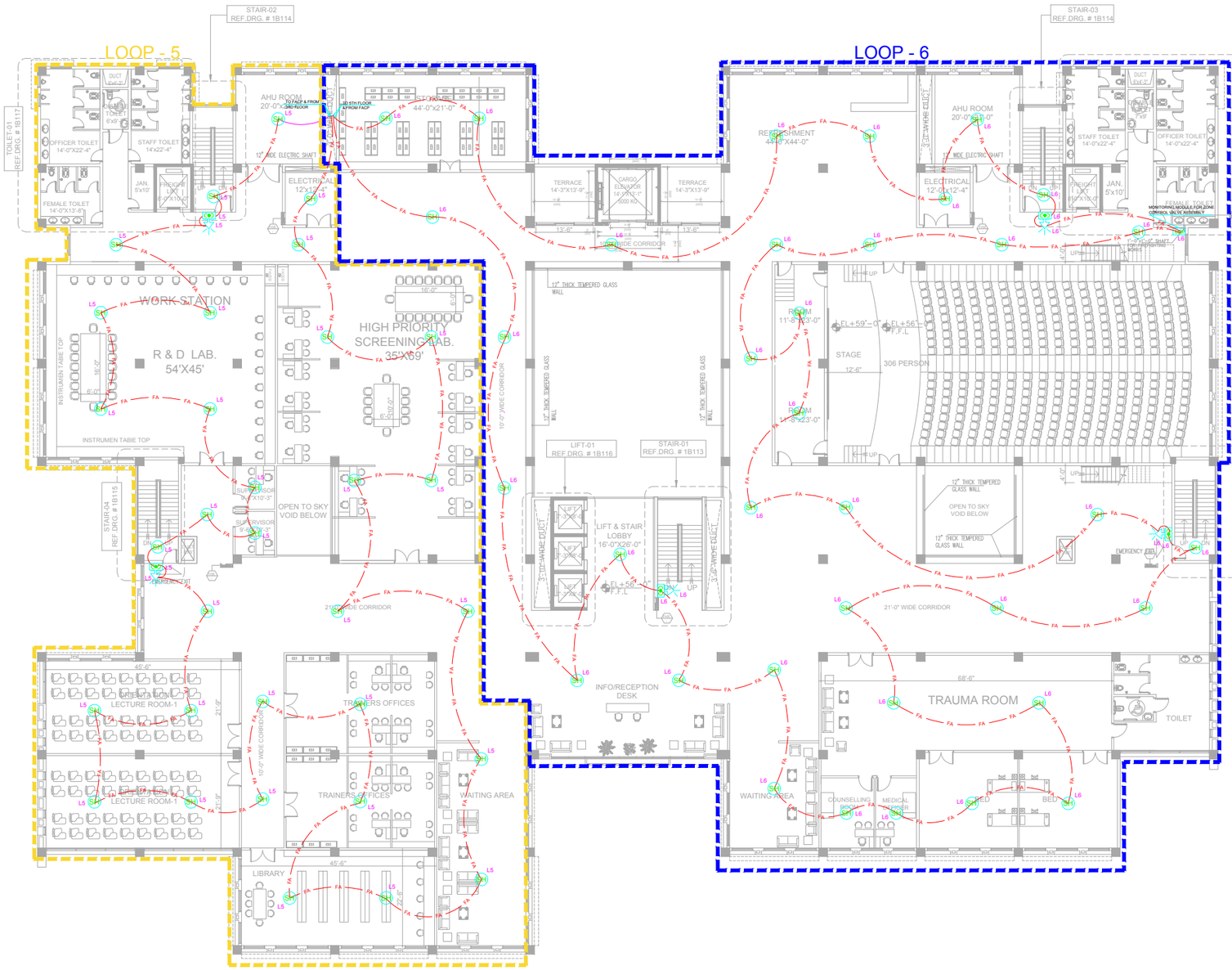
DRAWING No.: **4268/04/CD/ E002**

SCALE: NTS

REV.: 0

C:\USERS\USER\DESKTOP\MAIN BUILDING\FIRE ALARM\01_SCHEMATIC DIAGRAM.DWG

3/64"=1'-0" SHEET SIZE: A2



NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/CD/E001
3. FOR ADDRESSABLE FIRE ALARM SYSTEM SCHEMATIC DIAGRAM REFER DRAWING NO. 4268/04/CD/E002

LEGEND:-

SYMBOL	DESCRIPTION
SH	INTELLIGENT ADDRESSABLE LOOP POWERED OPTICAL SMOKE & HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
H	INTELLIGENT ADDRESSABLE LOOP POWERED HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
Tx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (TRANSMITTER)
Rx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (RECEIVER)
	ADDRESSABLE LOOP POWERED MANUAL CALL POINT WITH BASE & BUILT-IN ISOLATOR.
	ADDRESSABLE LOOP POWERED AUDIO VISUAL SOUNDER WITH BASE BUILT-IN ISOLATOR.
CM	ADDRESSABLE LOOP POWERED CONTROL/OUTPUT MODULE
MM	ADDRESSABLE LOOP POWERED MONITOR/INPUT MODULE
FACP	INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL WITH BACKUP BATTERIES, BATTERIES CHARGER & NETWORK CARD COMPLETE IN ALL RESPECT
AP	ADRESSABLE FIRE ALARM REPEATER/ANNUNCIATION PANEL INCLUDING ALL MOUNTING AND INSTALLATION ACCESSORIES.

4TH FLOOR PLAN

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
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APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
4th FLOOR

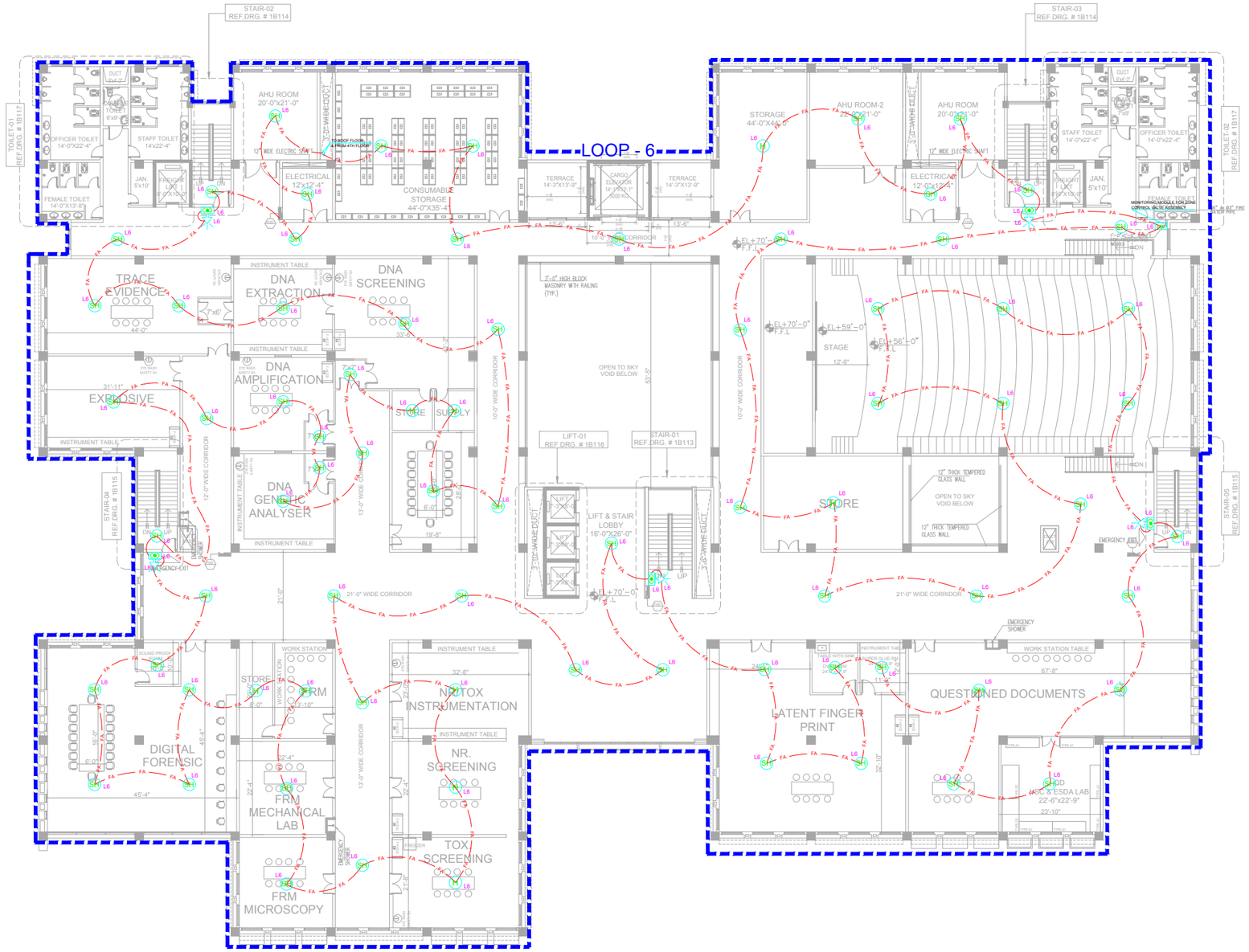
SCALE: 3/64"=1'-0"

DATE: APRIL, 2024

DRAWING No.: **4268/04/CD/1E106**

REV.: 0

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3/64"=1'-0" SHEET SIZE: A2



5TH FLOOR PLAN

NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/CD/E001
3. FOR ADDRESSABLE FIRE ALARM SYSTEM SCHEMATIC DIAGRAM REFER DRAWING NO. 4268/04/CD/E002

LEGEND:-

SYMBOL	DESCRIPTION
SH	INTELLIGENT ADDRESSABLE LOOP POWERED OPTICAL SMOKE & HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
H	INTELLIGENT ADDRESSABLE LOOP POWERED HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
Tx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (TRANSMITTER)
Rx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (RECEIVER)
	ADDRESSABLE LOOP POWERED MANUAL CALL POINT WITH BASE & BUILT-IN ISOLATOR.
	ADDRESSABLE LOOP POWERED AUDIO VISUAL SOUNDER WITH BASE BUILT-IN ISOLATOR.
CM	ADDRESSABLE LOOP POWERED CONTROL/OUTPUT MODULE
MM	ADDRESSABLE LOOP POWERED MONITOR/INPUT MODULE
FACP	INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL WITH BACKUP BATTERIES, BATTERIES CHARGER & NETWORK CARD COMPLETE IN ALL RESPECT
AP	ADRESSABLE FIRE ALARM REPEATER/ANNUNCIATION PANEL INCLUDING ALL MOUNTING AND INSTALLATION ACCESSORIES.

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
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RECOMMENDED	
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APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
5th FLOOR

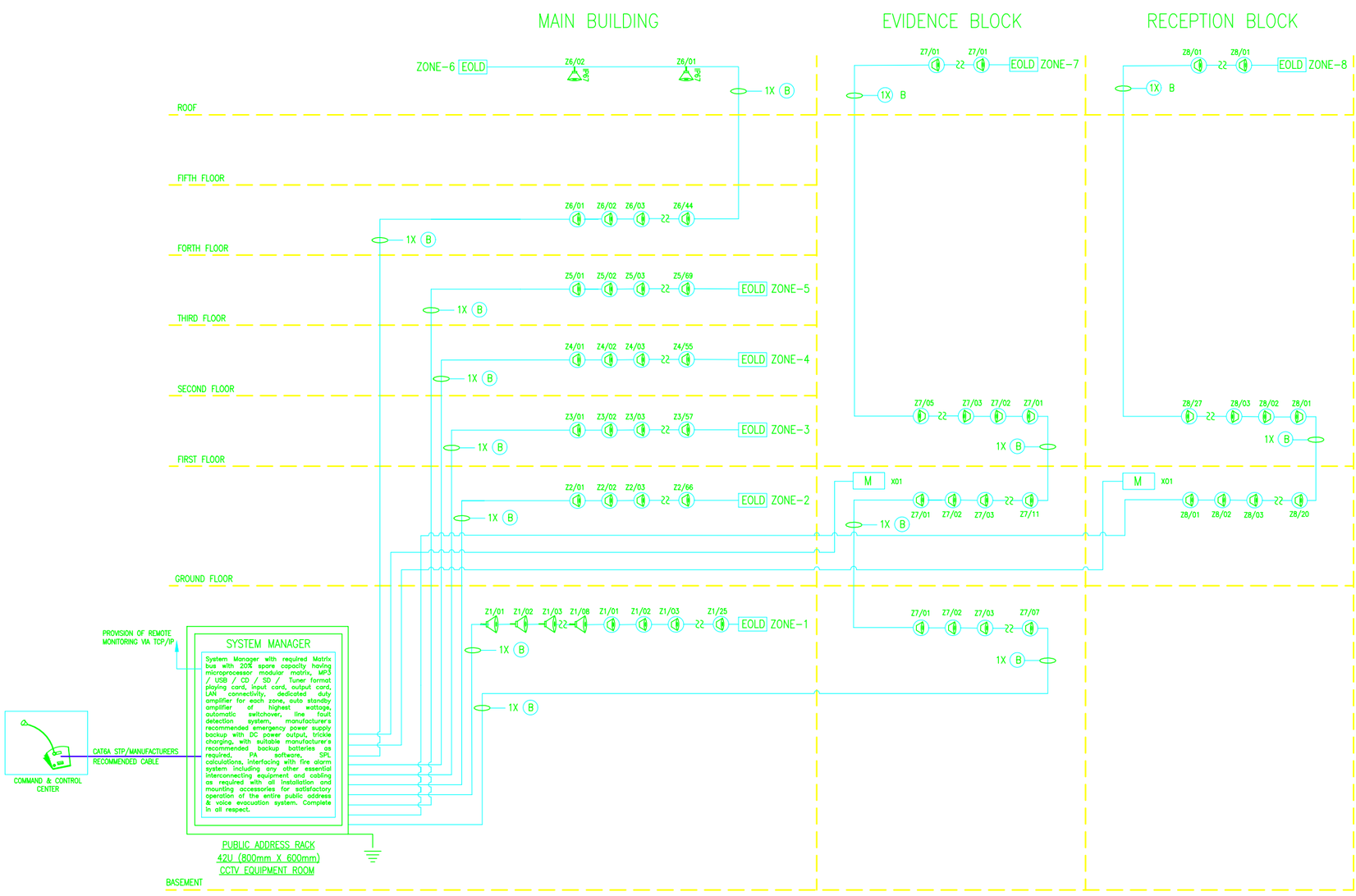
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DATE: APRIL, 2024

DRAWING No.: **4268/04/CD/1E107**

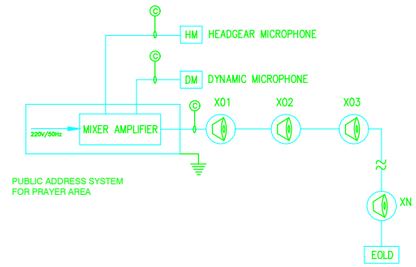
REV.: 0

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3/64"=1'-0" SHEET SIZE: A0



NOTES:–

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/CD/E001.
3. FOR EXTERNAL CONNECTIVITY OF PUBLIC ADDRESS NETWORK LAYOUT REFER DRAWING NO. 4268/04/CD/4IT114.
4. CONTRACTOR TO CARRYOUT DETAILED ENGINEERING DESIGN FOR PUBLIC ADDRESS SYSTEM IN PRAYER AREA.
5. CONTRACTOR TO PROVIDE DEDICATED AMPLIFIER FOR EACH ZONE AS PER APPROVED MANUFACTURER.



PUBLIC ADDRESS SYSTEM FOR PRAYER AREA

ZONES	NO OF SPEAKERS	LOAD(W)	EXPENSION%
ZONE–1	33	270W	20%
ZONE–2	66	396W	20%
ZONE–3	57	342W	20%
ZONE–4	55	330W	20%
ZONE–5	69	414W	20%
ZONE–6	46	294W	20%
ZONE–7	24	144W	20%
ZONE–8	48	288W	20%

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
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RECOMMENDED	RW
CHD./VER.	
APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

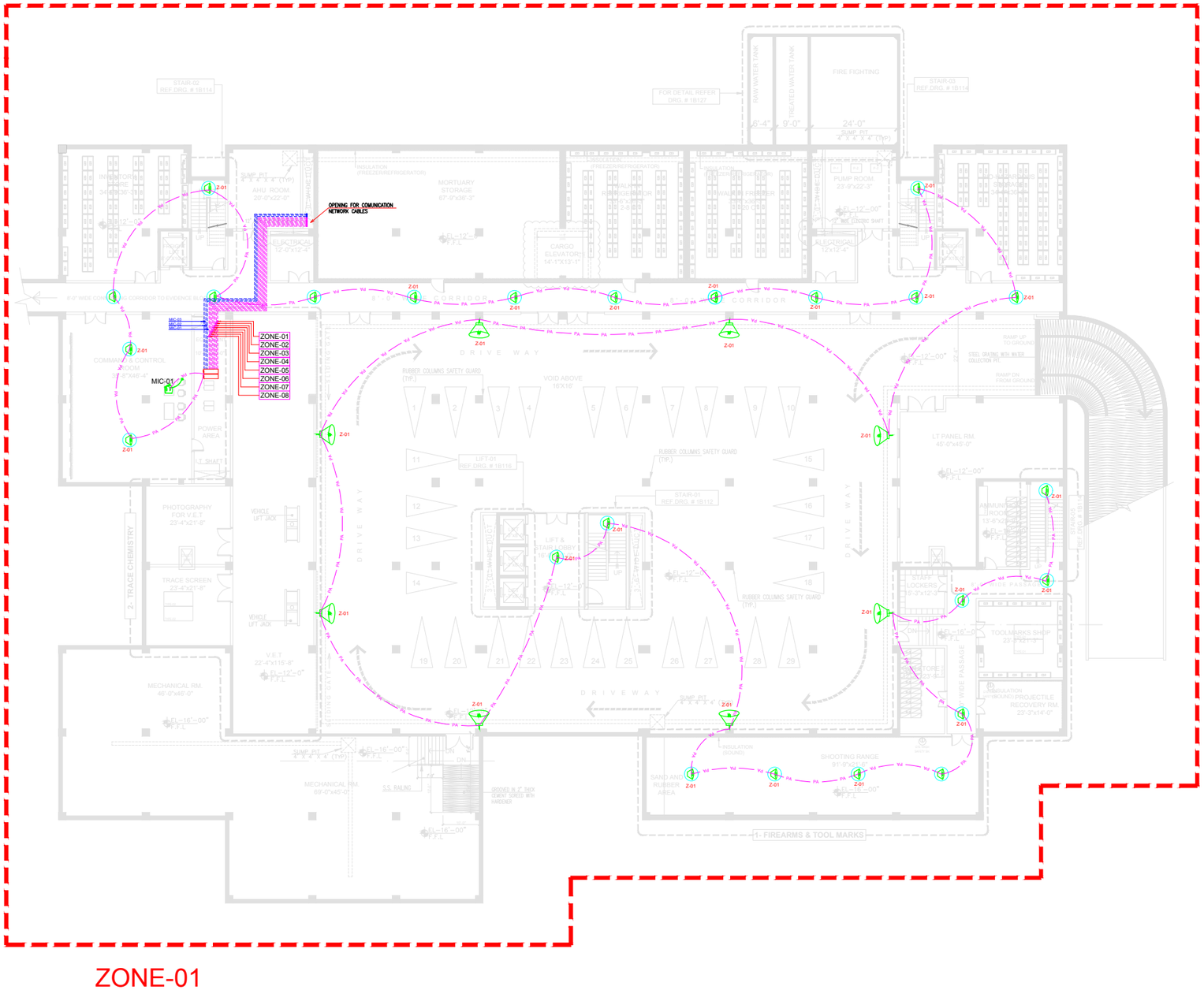
PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC DIAGRAM

DATE: APRIL, 2023

DRAWING No.: 4268/04/CD/E003

SCALE

REV.: 0



LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
Z-X / XX	SPEAKER NUMBER ZONE NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/CD/E001
3. FOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC REFER DRAWING NO. 4268/04/CD/E003

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED	APPROVED
04				DRAWN
03				SUBMITTED
02				RECOMMENDED
01				CHD./VER.

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
BASEMENT FLOOR
PUBLIC ADDRESS AND VOICE EVACUATION SYSTEM LAYOUT

SCALE: 3/64"=1'-0"

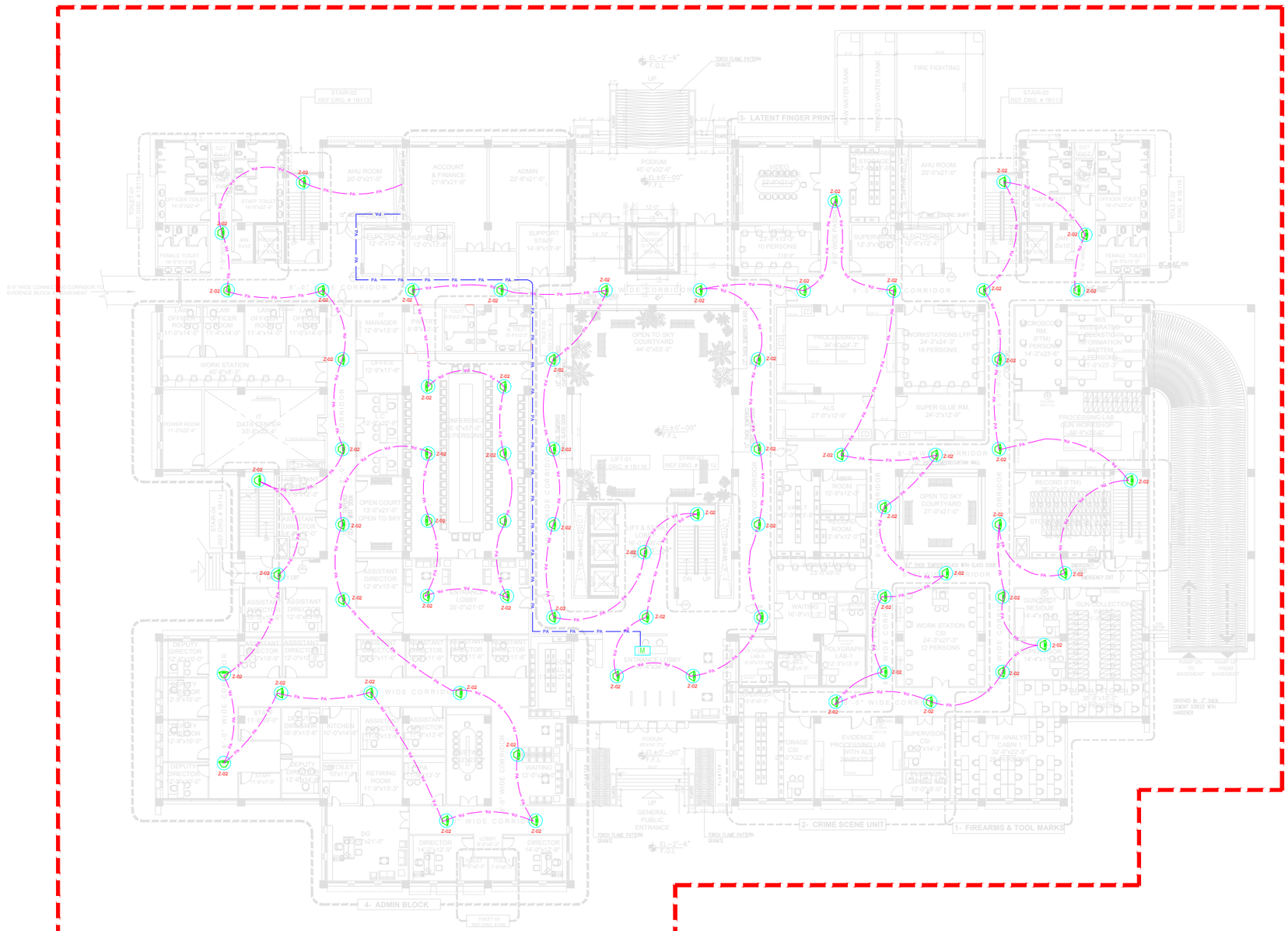
DATE: APRIL, 2023

DRAWING No.: **4268/04/CD/1E107**

REV.: 0

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3/64"=1'-0" SHEET SIZE: A2





LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
Z-X / XX	SPEAKER NUMBER ZONE NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/CD/E001
3. FOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC REFER DRAWING NO. 4268/04/CD/E003

CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED	APPROVED
04				DRAWN
03				SUBMITTED
02				RECOMMENDED
01				CHD./VER.

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
GROUND FLOOR
PUBLIC ADDRESS AND VOICE EVACUATION SYSTEM LAYOUT

SCALE: 3/64"=1'-0"

DATE: APRIL, 2023

DRAWING No.: **4268/04/CD/1E108**

REV.: 0

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LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
Z-X / XX	SPEAKER NUMBER ZONE NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/CD/E001
3. FOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC REFER DRAWING NO. 4268/04/CD/E003

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HOME DEPARTMENT,
GOVERNMENT OF SINDH

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REV.	DATE	DESCRIPTION	APPROVED
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RECOMMENDED	R.W
CHD./VER.	
APPROVED	

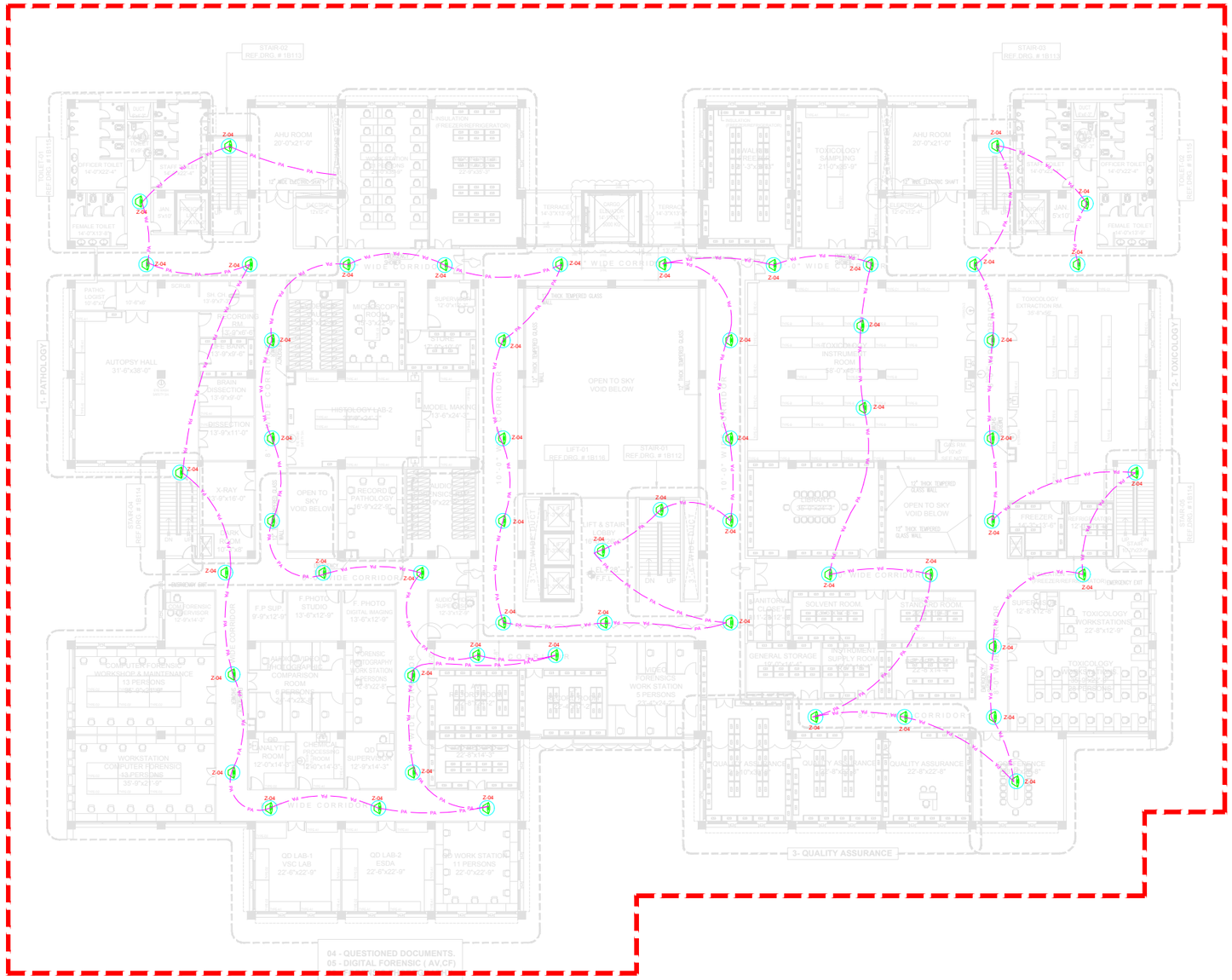
PROJECT
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
FIRST FLOOR
PUBLIC ADDRESS AND VOICE EVACUATION SYSTEM LAYOUT

DATE: APRIL, 2023
DRAWING No.: **4268/04/CD/1E109**

SCALE: 3/64"=1'-0"
REV.: 0

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LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
Z-X / XX	SPEAKER NUMBER ZONE NUMBER

NOTES:-

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3. FOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC REFER DRAWING NO. 4268/04/CD/E003

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REV.	DATE	DESCRIPTION	APPROVED	
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03				SUBMITTED
02				RECOMMENDED
01				CHD./VER.
				APPROVED

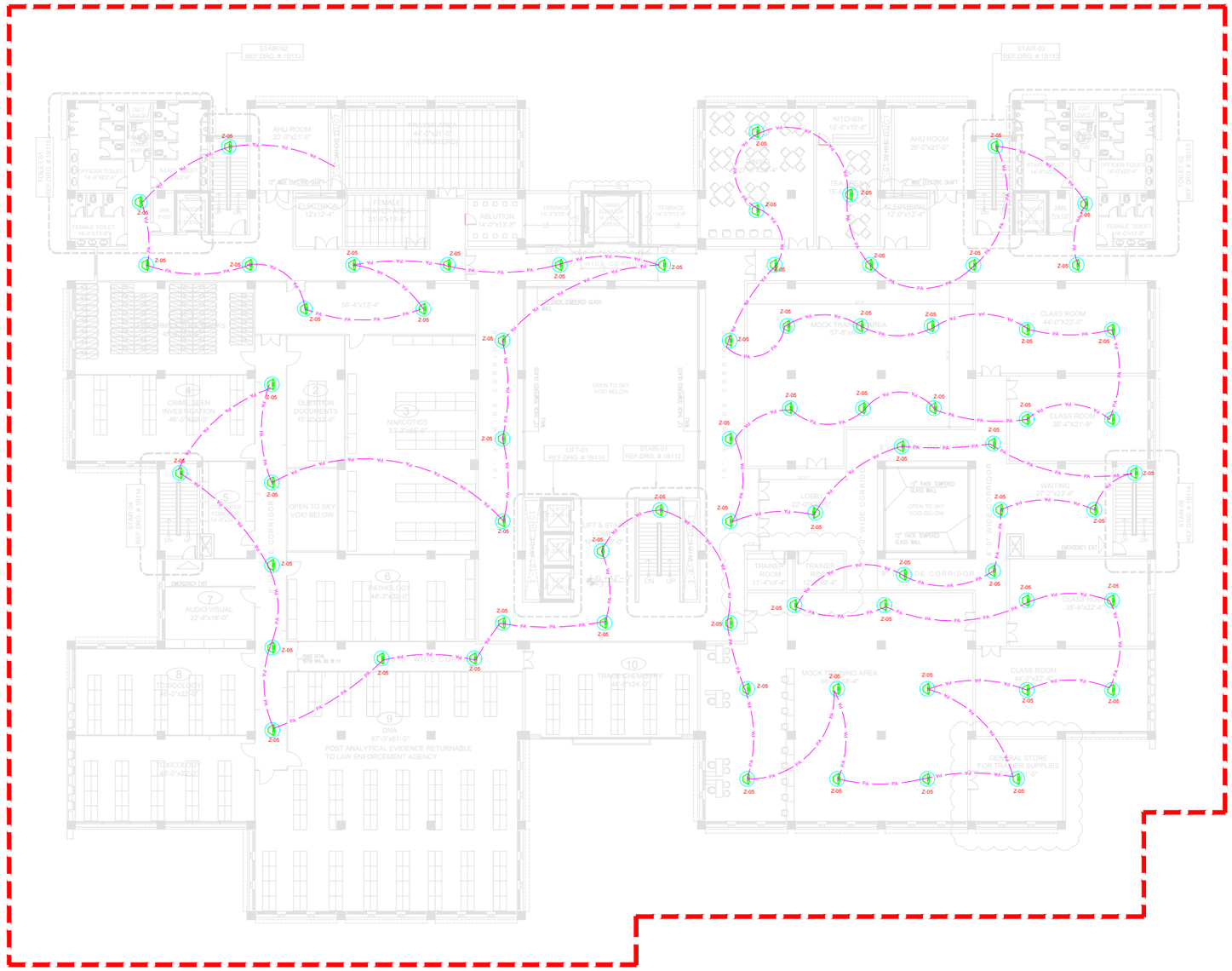
PROJECT
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
SECOND FLOOR
PUBLIC ADDRESS AND VOICE EVACUATION SYSTEM LAYOUT

DATE: APRIL, 2023
DRAWING No.: 4268/04/CD/1E110

SCALE: 3/64"=1'-0"
REV.: 0

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LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
Z-X / XX	SPEAKER NUMBER ZONE NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/CD/E001
3. FOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC REFER DRAWING NO. 4268/04/CD/E003

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REV.	DATE	DESCRIPTION	APPROVED
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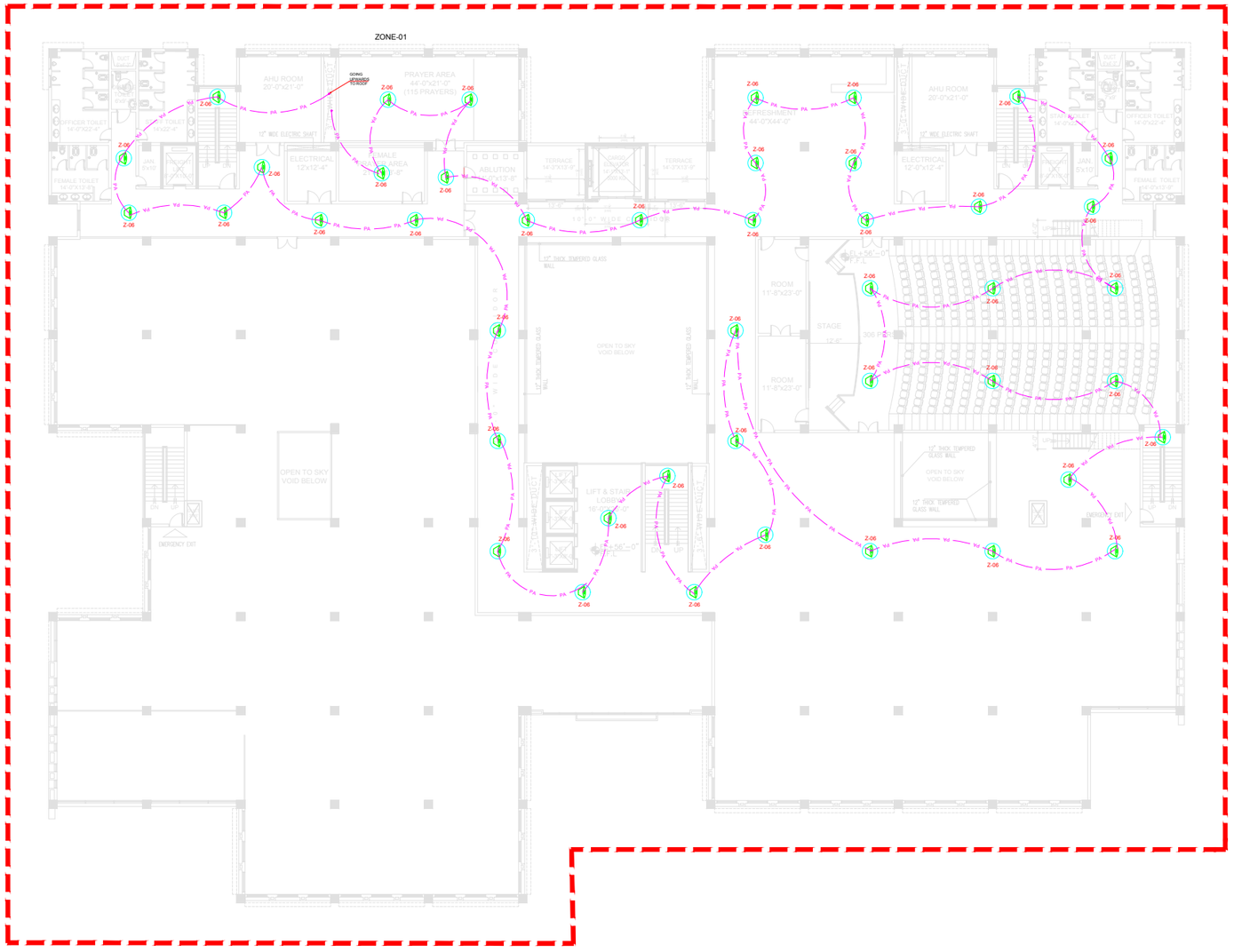
DRAWN	
SUBMITTED	
RECOMMENDED	R.W
CHD./VER.	
APPROVED	

PROJECT
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
THIRD FLOOR
PUBLIC ADDRESS AND VOICE EVACUATION SYSTEM LAYOUT

DATE: APRIL, 2023
DRAWING No.: **4268/04/CD/1E111**
SCALE: 3/64"=1'-0"
REV.: 0

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LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
Z-X / XX	SPEAKER NUMBER ZONE NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/CD/E001
3. FOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC REFER DRAWING NO. 4268/04/CD/E003

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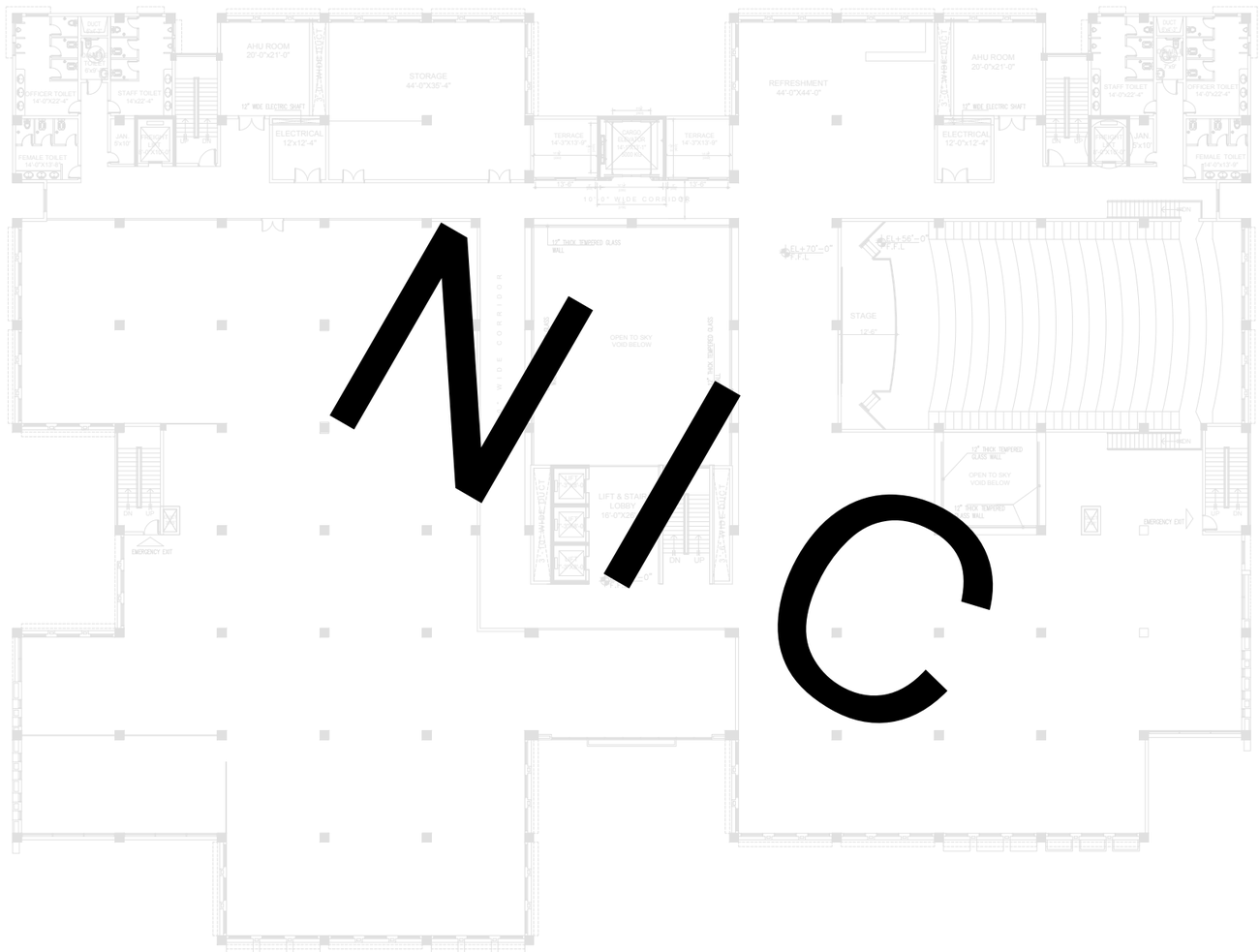
REV.	DATE	DESCRIPTION	APPROVED	APPROVED
04				DRAWN
03				SUBMITTED
02				RECOMMENDED
01				CHD./VER.

PROJECT
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
4th FLOOR
PUBLIC ADDRESS AND VOICE EVACUATION SYSTEM LAYOUT

DATE: APRIL, 2023
DRAWING No.: **4268/04/CD/1E112**
SCALE: 3/64"=1'-0"
REV.: 0

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REV.	DATE	DESCRIPTION	APPROVED	APPROVED
04				DRAWN
03				SUBMITTED
02				RECOMMENDED
01				CHD./VER.

PROJECT

ESTABLISHMENT OF SINDH
FORENSIC SCIENCE LABORATORY
KARACHI

MAIN BUILDING
5th FLOOR

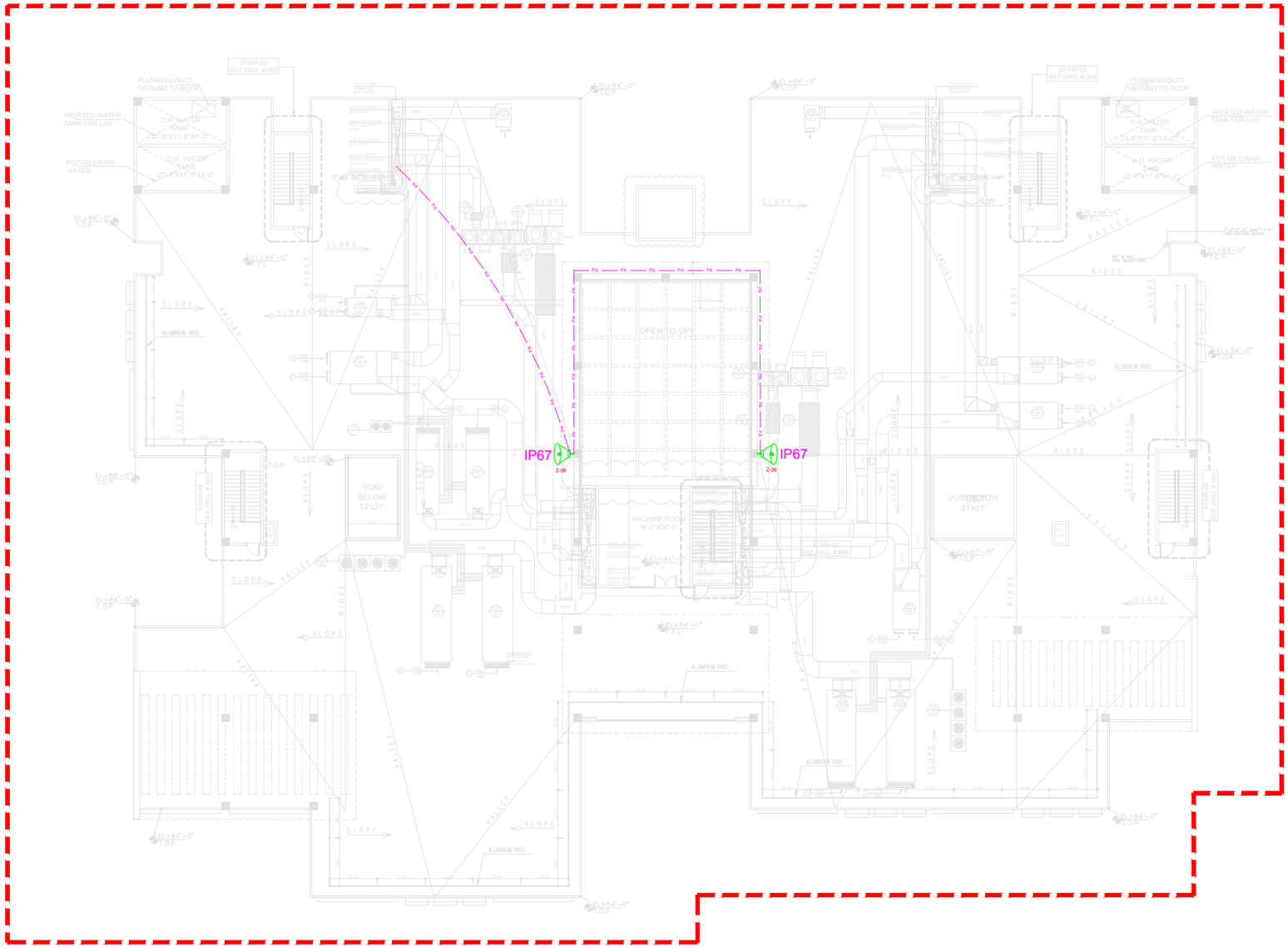
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DATE: APRIL, 2023

DRAWING No.: **4268/04/CD/1E113**

REV.: 0

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ZONE-06

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LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
Z-X / XX	SPEAKER NUMBER ZONE NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/CD/E001
3. FOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC REFER DRAWING NO. 4268/04/CD/E003

CLIENT
HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
04			
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DRAWN	
SUBMITTED	
RECOMMENDED	R.W
CHD./VER.	
APPROVED	

PROJECT
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
ROOF FLOOR
PUBLIC ADDRESS AND VOICE EVACUATION SYSTEM LAYOUT

DATE: APRIL, 2023
DRAWING No.: **4268/04/CD/1E114**

SCALE: 3/64"=1'-0"
REV.: 0

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HOME DEPARTMENT,
GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED	APPROVED
01				
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SUBMITTED	
RECOMMENDED	R.W
CHD./VER.	
APPROVED	

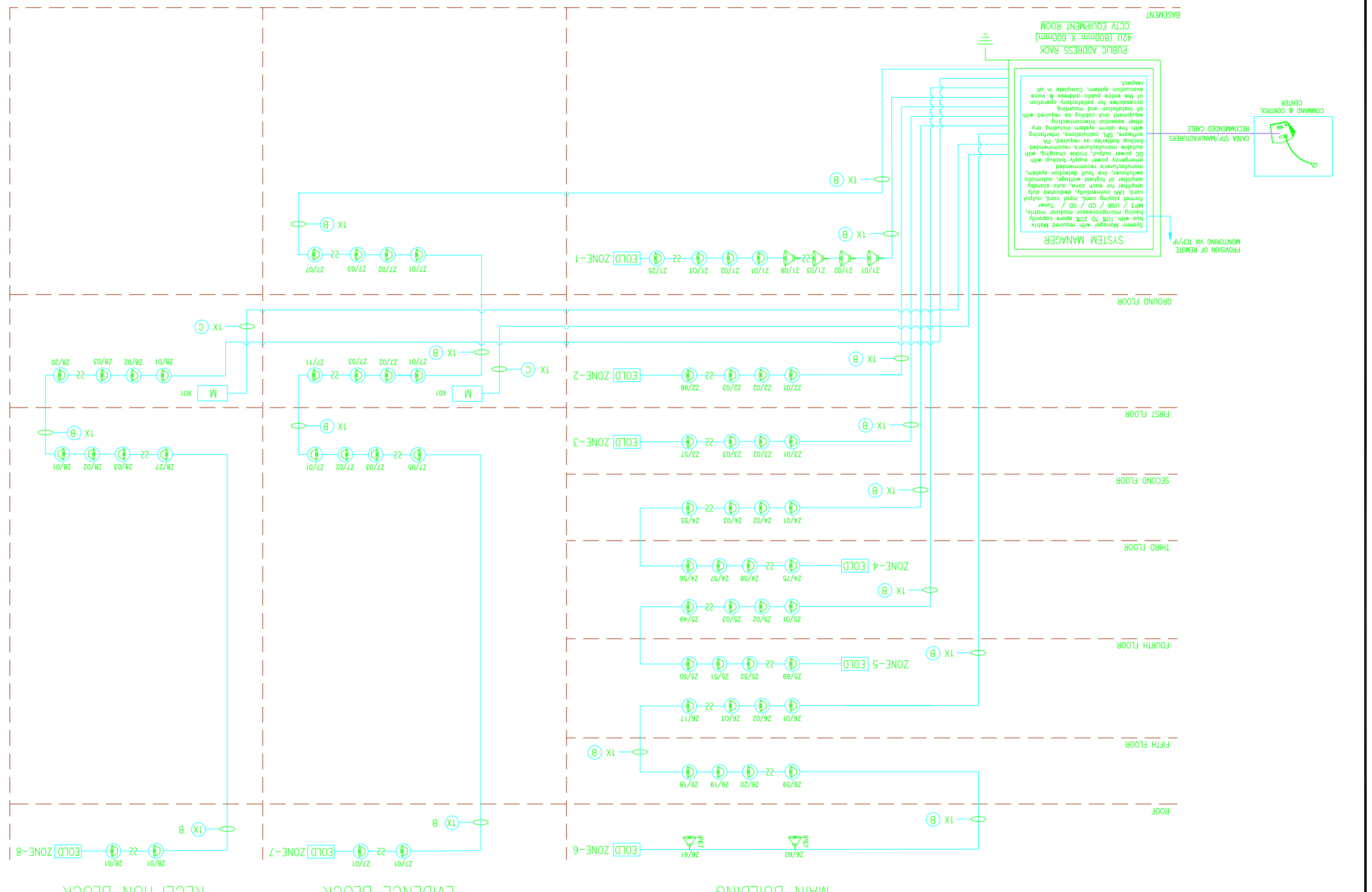
PROJECT

ESTABLISHMENT OF SINDH
FORENSIC SCIENCE LABORATORY
KARACHI

SCALE

PUBLIC ADDRESS & VOICE EVACUATION SYSTEM
SCHEMATIC DIAGRAM

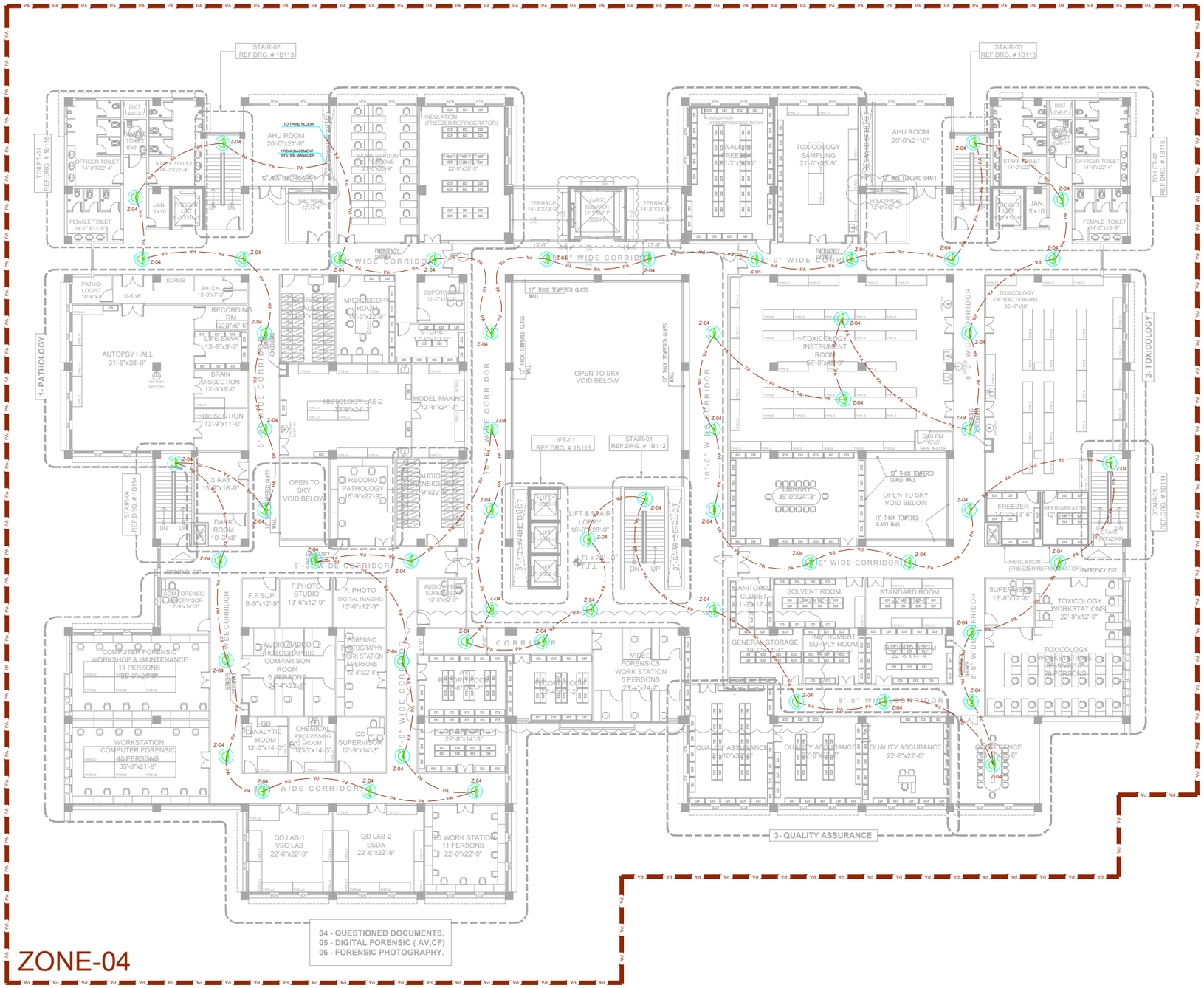
DATE	DRAWING No.	REV.
APRIL, 2024	4268/04/CD/E003	0



NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/CD/E001.
3. FOR EXTERNAL CONNECTIVITY OF PUBLIC ADDRESS NETWORK LAYOUT REFER DRAWING NO. 4268/04/CD/41114.
4. CONTRACTOR TO PROVIDE DEDICATED AMPLIFIER FOR EACH ZONE AS PER APPROVED MANUFACTURER.

ZONES	NO OF SPEAKERS	LOAD(W)	EXPENSION%
ZONE-1	33	270W	20%
ZONE-2	66	396W	20%
ZONE-3	57	342W	20%
ZONE-4	75	450W	10%
ZONE-5	69	414W	12%
ZONE-6	61	384W	20%
ZONE-7	24	144W	20%
ZONE-8	48	288W	20%



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LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
Z-X / XX	SPEAKER NUMBER ZONE NUMBER

NOTES:-

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CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
04			
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SUBMITTED	
RECOMMENDED	R.W
CHD./VER.	
APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
SECOND FLOOR
PUBLIC ADDRESS AND VOICE EVACUATION SYSTEM LAYOUT

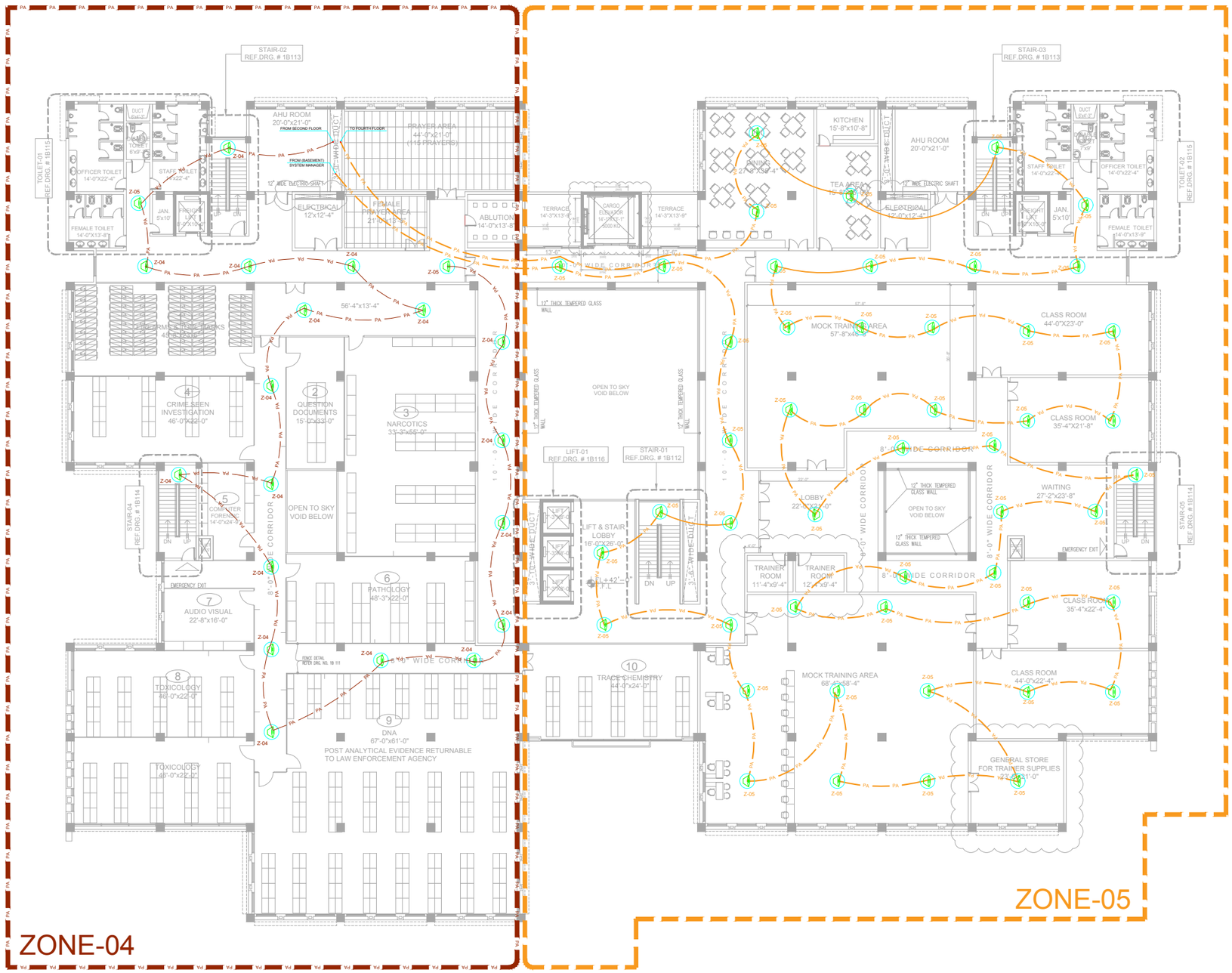
DATE: APRIL, 2024

DRAWING No.: **4268/04/CD/1E110**

SCALE: 3/64"=1'-0"

REV.: 0

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3/64"=1'-0" SHEET SIZE: X0





LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
Z-X / XX	SPEAKER NUMBER ZONE NUMBER

NOTES:-

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REV.	DATE	DESCRIPTION	APPROVED
04			
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SUBMITTED	
RECOMMENDED	R.W
CHD./VER.	
APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
THIRD FLOOR
PUBLIC ADDRESS AND VOICE EVACUATION SYSTEM LAYOUT

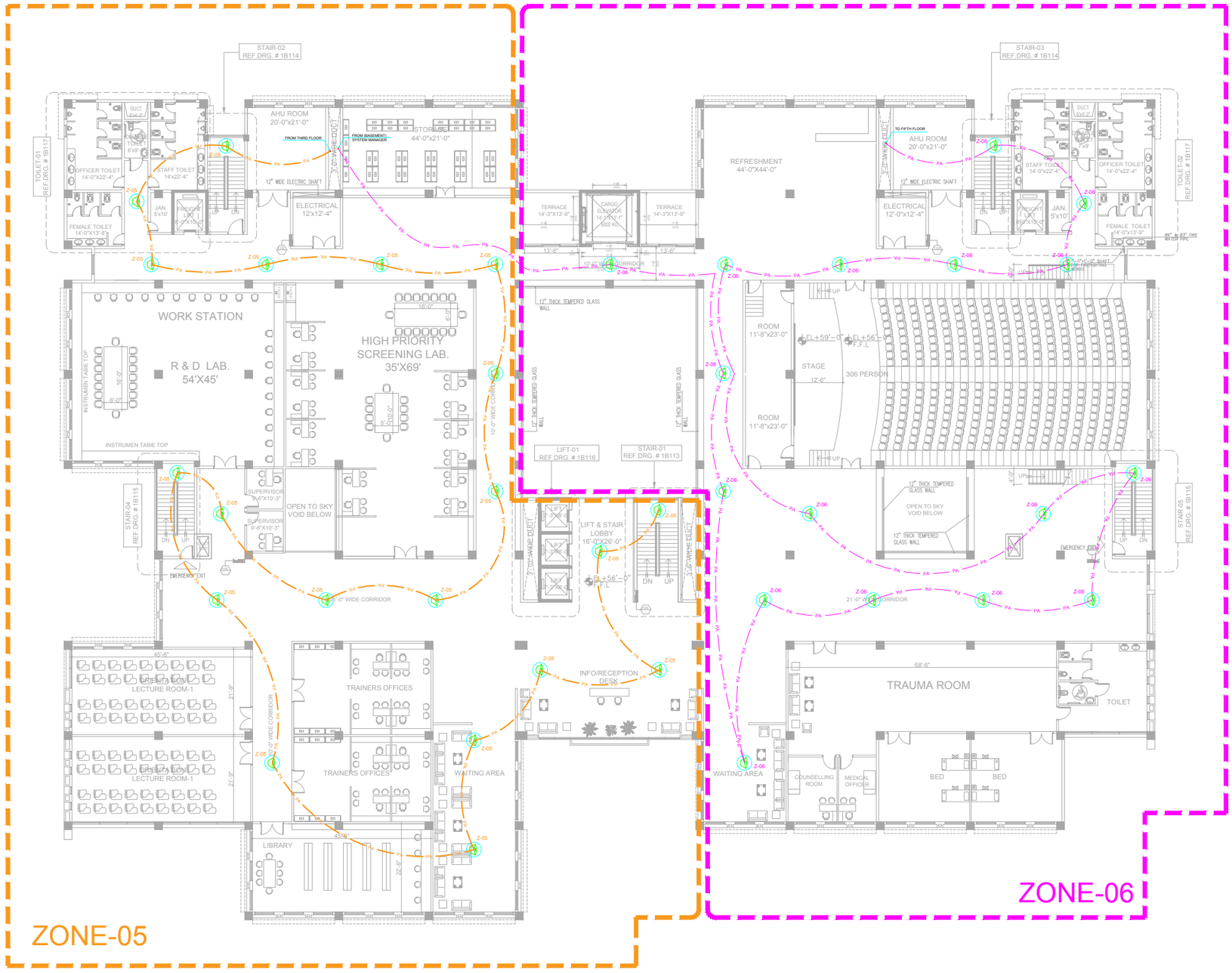
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DATE: APRIL, 2024

DRAWING No.: **4268/04/CD/1E111**

REV.: 0

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3/64"=1'-0" SHEET SIZE: A2



LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
Z-X / XX	SPEAKER NUMBER ZONE NUMBER

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CLIENT
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REV.	DATE	DESCRIPTION	APPROVED
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SUBMITTED	
RECOMMENDED	R.W
CHD./VER.	
APPROVED	

PROJECT
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
4th FLOOR
PUBLIC ADDRESS AND VOICE EVACUATION SYSTEM LAYOUT

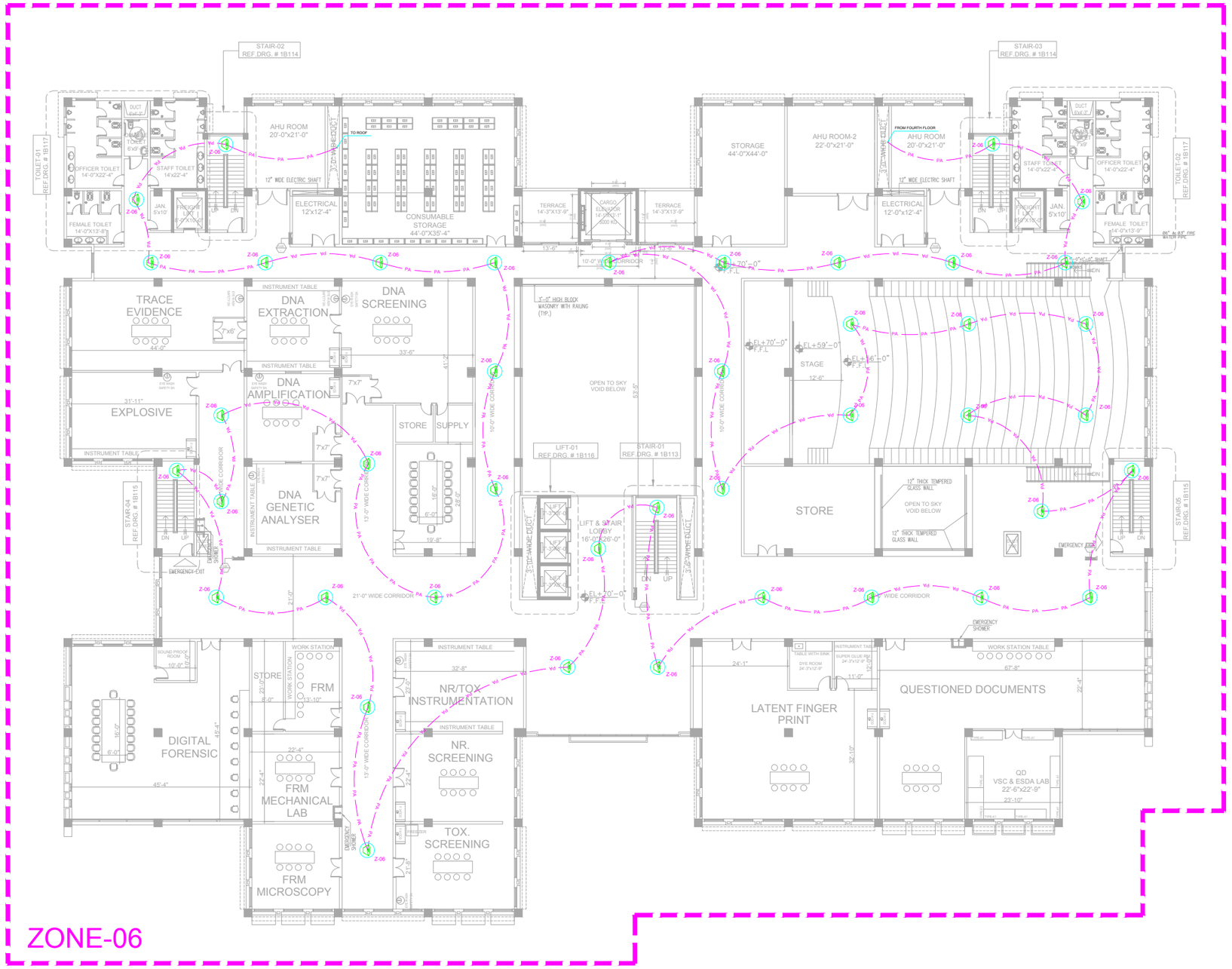
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DATE: APRIL, 2024

DRAWING No.: **4268/04/CD/1E112**

REV.: 0

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3/64"=1'-0" SHEET SIZE: A2





LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
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	PUBLIC ADDRESS RACK
Z-X / XX	SPEAKER NUMBER ZONE NUMBER

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CLIENT

HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi, Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
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SUBMITTED	
RECOMMENDED	R.W
CHD./VER.	
APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING
5th FLOOR

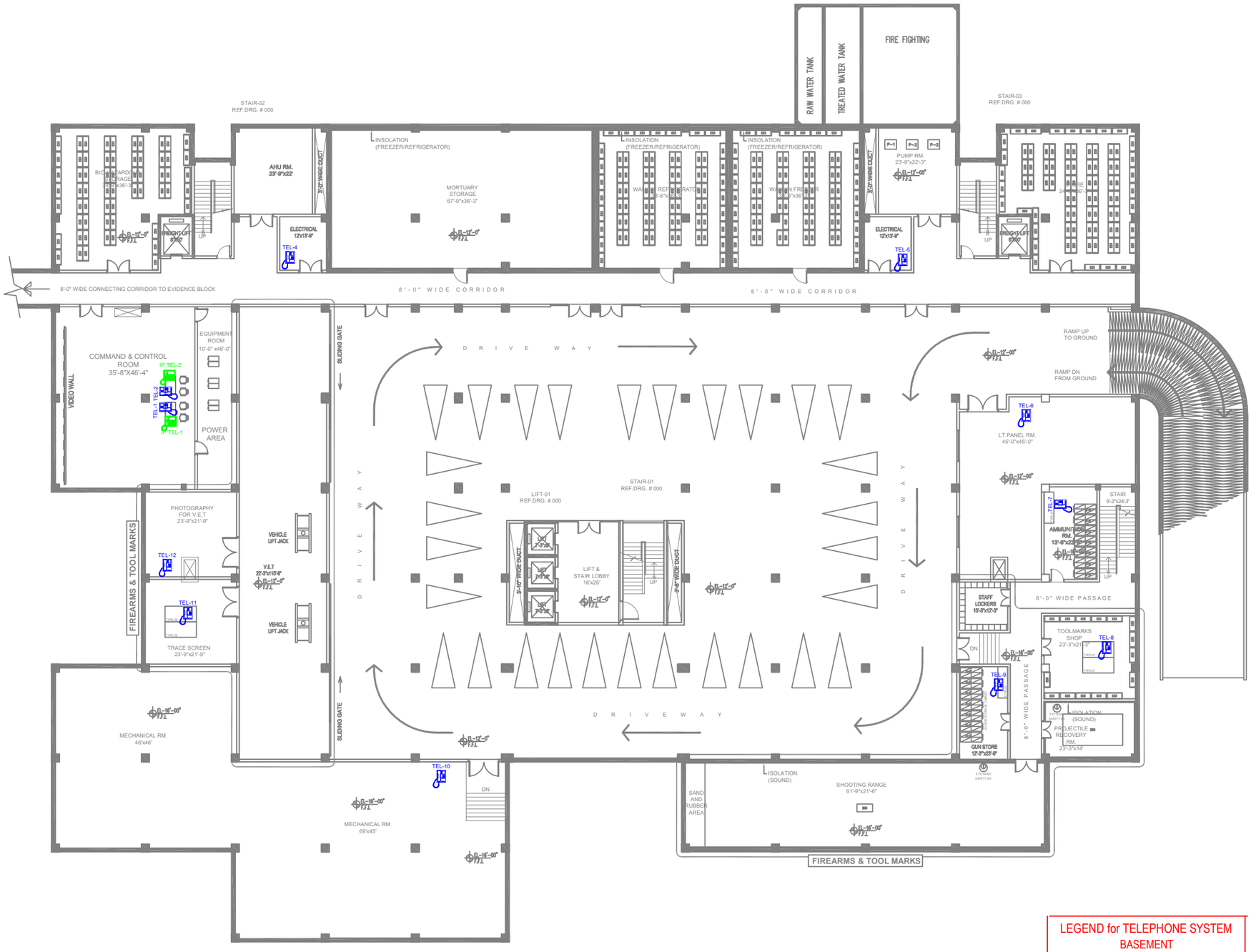
SCALE: 3/64"=1'-0"

DATE: APRIL, 2024

DRAWING No.: **4268/04/CD/1E113**

REV.: 0

E:\NAWAB\NESPAK\SINDH FORANSIC SCIENCE LEBORTARY 01_FAS,PAS,PIDS - (31-08-2022)_2\FIRE ALAM\04_PAS\02_MAIN BUILDING\NEW\FLOOR PLAN FINAL - COPY.DWG
3/64"=1'-0" SHEET SIZE: A2



NOTE:-

01 AT ALL GAS ROOMS IN 2"x6" SOLID WOODEN FLOOR 1' HIGH.
02 FREEZER / REFRIGERATOR ROOM SHOULD HAVE NON SLIPPERY FLOOR.
03 AUTOPSY ROOM MUST HAVE GLASS WALL FOR MAXIMUM LIGHT.
04 MICROSCOPY LABS SHOULD NOT HAVE WINDOWS.
05 POLYGRAPH LAB MUST HAVE ONEWAY SEE THROUGH WINDOWS.

LEGEND for TELEPHONE SYSTEM
BASEMENT

Sr.No	Qty.	ITEM	SYMBOL
1	02	EXECUTIVE IP TELEPHONE	
2	12	ANALOGUE TELEPHONE	

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

COVERED AREA = 53,655 Sq.Ft.

CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

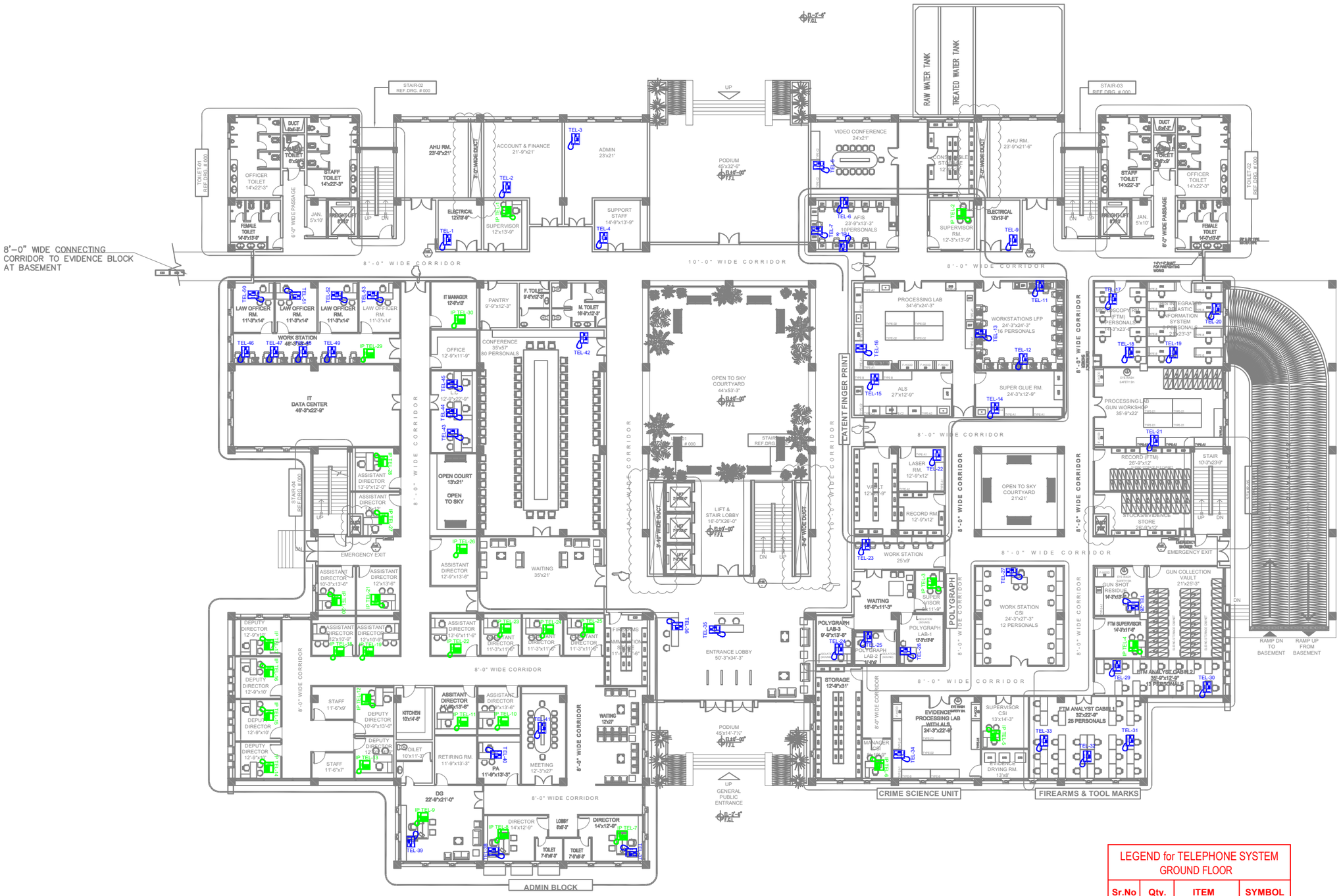
PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
BASEMENT TELEPHONE SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN.			
CKD.			
SUBM.			

DATE	DRAWING NO.	SCALE	REV.
AUG., 2022	4268/166/TD/1S001	3/63"=1'-0"	A



AREA LEGEND:-

BASEMENTCOVERED AREA	=	53,655 Sq.Ft.
GROUND FLOOR COVERED AREA	=	45,798 Sq.Ft.
FIRST FLOOR COVERED AREA	=	45,798 Sq.Ft.
SECOND FLOOR COVERED AREA	=	45,798 Sq.Ft.
THIRD FLOOR COVERED AREA	=	45,798 Sq.Ft.
COVERED AREA		**= 2,36,847 Sq.Ft.**

NOTE:-

01 AT ALL GAS ROOMS IN 2"x6" SOLID WOODEN FLOOR 1' HIGH.

02 FREEZER / REFRIGERATOR ROOM SHOULD HAVE NON SLIPPERY FLOOR.

03 AUTOPSY ROOM MUST HAVE GLASS WALL FOR MAXIMUM LIGHT.

04 MICROSCOPY LABS SHOULD NOT HAVE WINDOWS.

05 POLYGRAPH LAB MUST HAVE ONEWAY SEE THROUGH WINDOWS.

LEGEND for TELEPHONE SYSTEM GROUND FLOOR			
Sr.No	Qty.	ITEM	SYMBOL
1	30	EXECUTIVE IP TELEPHONE	
2	53	ANALOGUE TELEPHONE	

COVERED AREA = 45,798 Sq.Ft.

CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
GROUND FLOOR TELEPHONE SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN.			
CKD.			
SUBM.			
	DATE AUG., 2022	DRAWING NO. 4268/166/TD/1S002	SCALE 3/63"=1'-0" REV. A



NOTE:-

01 AT ALL GAS ROOMS IN 2"x6" SOLID WOODEN FLOOR 1' HIGH.

02 FREEZER / REFRIGERATOR ROOM SHOULD HAVE NON SLIPPERY FLOOR.

03 AUTOPSY ROOM MUST HAVE GLASS WALL FOR MAXIMUM LIGHT.

04 MICROSCOPY LABS SHOULD NOT HAVE WINDOWS.

05 POLYGRAPH LAB MUST HAVE ONEWAY SEE THROUGH WINDOWS.

LEGEND for TELEPHONE SYSTEM
FIRST FLOOR

Sr.No	Qty.	ITEM	SYMBOL
1	03	EXECUTIVE IP TELEPHONE	
2	51	ANALOGUE TELEPHONE	

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

COVERED AREA = 45,798 Sq.Ft.

CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

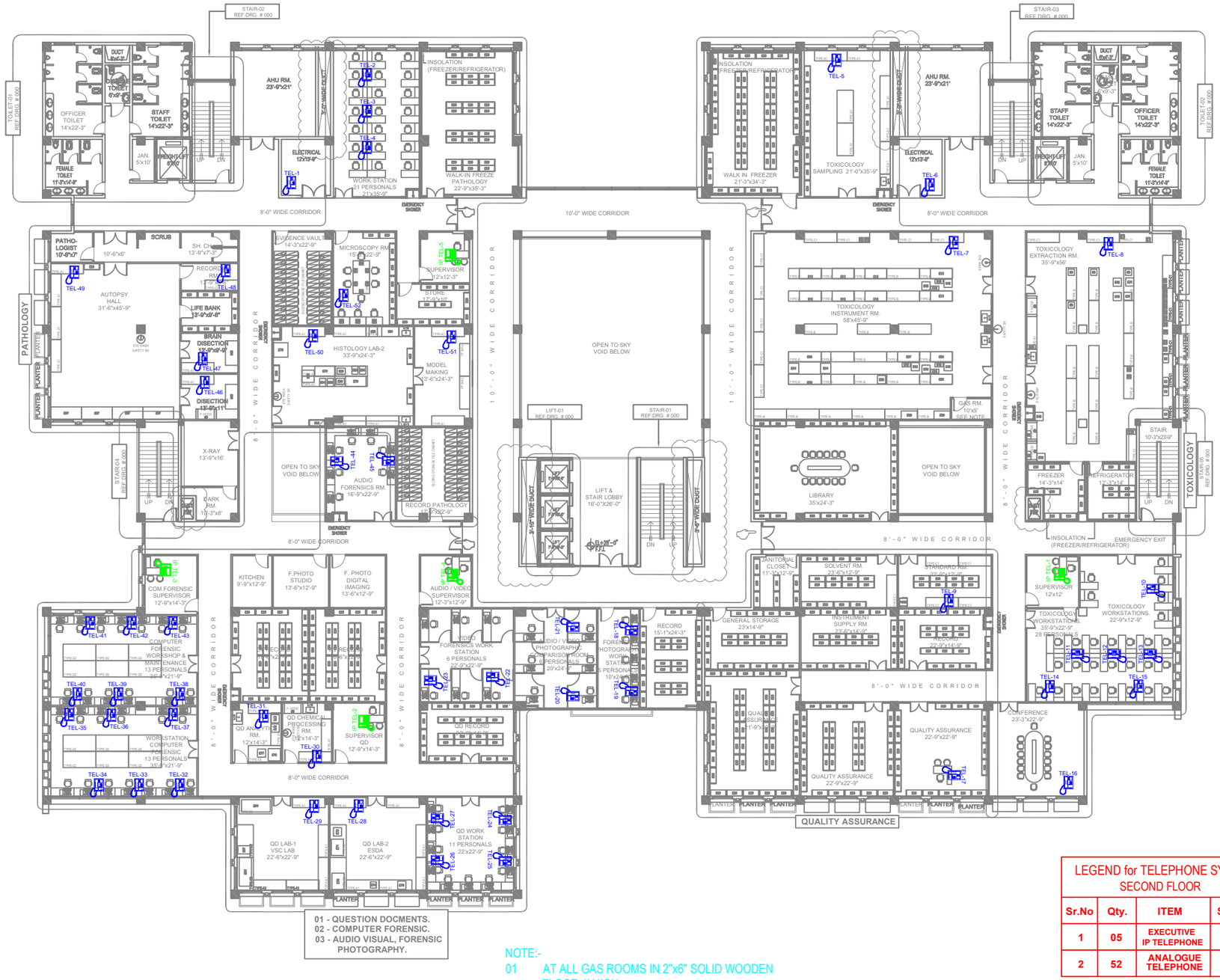
PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
FIRST FLOOR TELEPHONE SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN.			
CKD.			
SUBM.			

DATE	DRAWING NO.	SCALE	REV.
AUG., 2022	4268/166/TD/1S003	3/63"=1'-0"	A



NOTE:-

01 AT ALL GAS ROOMS IN 2"x6" SOLID WOODEN FLOOR 1' HIGH.

02 FREEZER / REFRIGERATOR ROOM SHOULD HAVE NON SLIPPERY FLOOR.

03 AUTOPSY ROOM MUST HAVE GLASS WALL FOR MAXIMUM LIGHT.

04 MICROSCOPY LABS SHOULD NOT HAVE WINDOWS.

05 POLYGRAPH LAB MUST HAVE ONEWAY SEE THROUGH WINDOWS.

LEGEND for TELEPHONE SYSTEM
SECOND FLOOR

Sr.No	Qty.	ITEM	SYMBOL
1	05	EXECUTIVE IP TELEPHONE	
2	52	ANALOGUE TELEPHONE	

COVERED AREA = 45,798 Sq.Ft.

CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

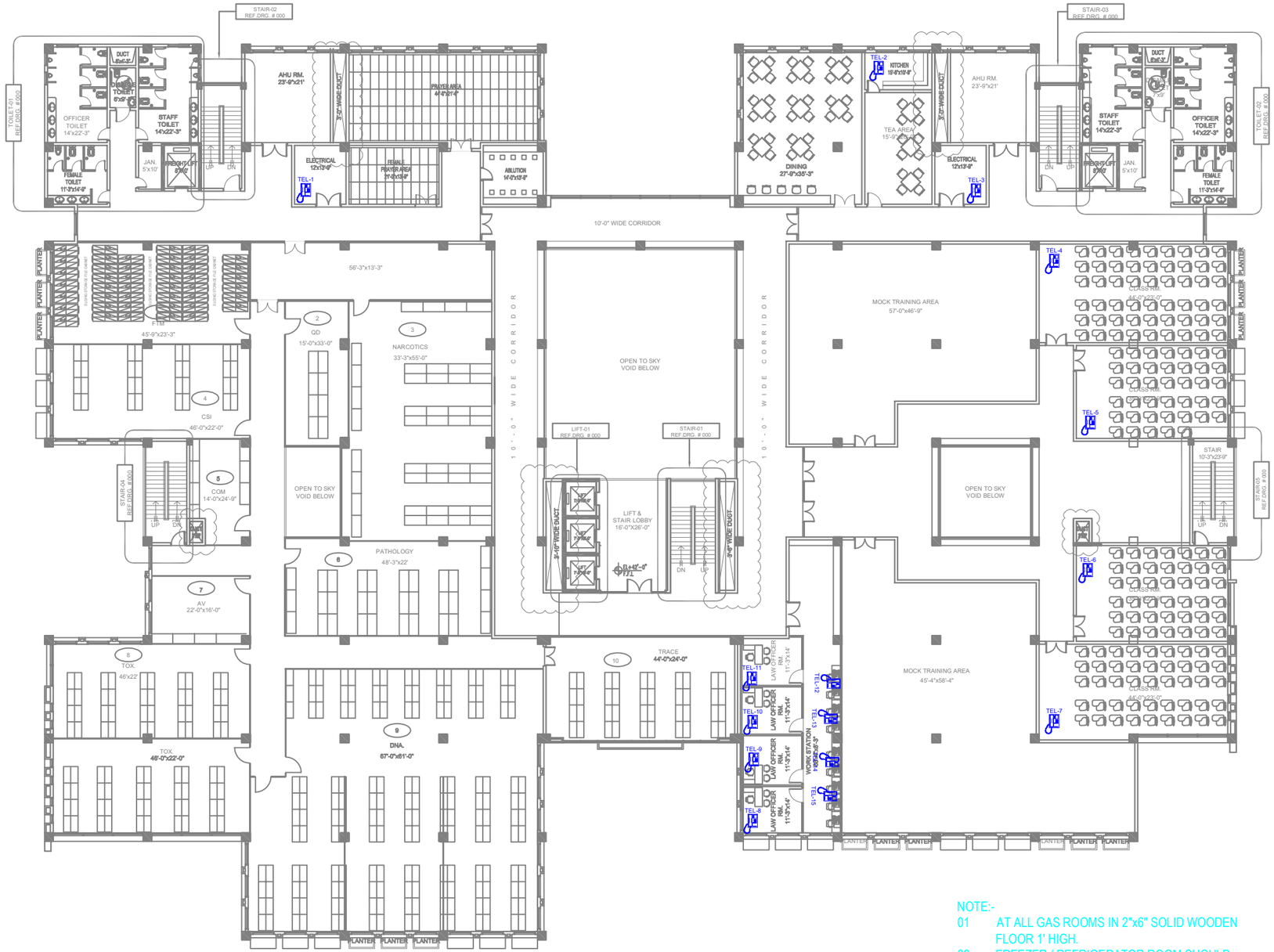
SHEET TITLE: MAIN BUILDING
SECOND FLOOR TELEPHONE SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN.			
CKD.			
SUBM.			

DATE	DRAWING NO.	SCALE	REV.
AUG., 2022	4268/166/TD/1S004	3/63"=1'-0"	A



TRAINING & MAIN STORAGE FLOOR

LEGEND for TELEPHONE SYSTEM THIRD FLOOR			
Sr.No	Qty.	ITEM	SYMBOL
1	00	EXECUTIVE IP TELEPHONE	
2	15	ANALOGUE TELEPHONE	

NOTE:-

01 AT ALL GAS ROOMS IN 2"x6" SOLID WOODEN FLOOR 1' HIGH.
02 FREEZER / REFRIGERATOR ROOM SHOULD HAVE NON SLIPPERY FLOOR.
03 AUTOPSY ROOM MUST HAVE GLASS WALL FOR MAXIMUM LIGHT.
04 MICROSCOPY LABS SHOULD NOT HAVE WINDOWS.
05 POLYGRAPH LAB MUST HAVE ONEWAY SEE THROUGH WINDOWS.

COVERED AREA = 45,798 Sq.Ft.

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
THIRD FLOOR TELEPHONE SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN.			
CKD.	DATE	DRAWING NO.	SCALE / REV.
SUBM.	AUG., 2022	4268/166/TD/1S005	3/63"=1'-0" / A

HOME DEPARTMENT
GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH
FORENSIC SCIENCE LABORATORY KARACHI
MAIN BUILDING

INTEGRATED BUILDING MANAGEMENT SYSTEM

TENDER DRAWINGS

APRIL, 2025

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED
13th Floor, N.I.C. Building, Abbasi Shaheed Road, Off. Shahrah-e-Faisal, Karachi
PABX:+92-21-99090000 Fax : +92-21-35651994, 99225366
E-mail : karachi@nespak.com.pk, Website: www.nespak.com.pk

LIST OF DRAWINGS

SR. NO.	DRAWING NO.	REV NO.	TITLE	SCALE	REMARKS
01	4268/04 /TD/1J01	0	LEGEND, LIST OF DRAWINGS AND GENERAL NOTES	N.T.S	
02	4268/04 /TD/1J02	0	INTEGRATED BUILDING MANAGEMENT SYSTEM (BMS) SCHEMATIC DIAGRAMS	N.T.S	
03	4268/04 /TD/1J03	0	INTEGRATED BUILDING MANAGEMENT SYSTEM (BMS) SCHEMATIC DIAGRAMS	N.T.S	

GENERAL NOTES:

1. READ THIS DRAWING WITH IN CONJUNCTION WITH ALL RELEVANT PROJECT DRAWING AND TECHNICAL SPECIFICATIONS.
2. THE CONTRACTOR IS REQUIRED TO THOROUGHLY STUDY THE SPECIFICATIONS, DRAWINGS AND SCHEDULE OF PRICES OF INTEGRATED BUILDING MANAGEMENT SYSTEM (ibms) AND ACCORDINGLY SUBMIT A COMPREHESIVE TECHNICAL SUBMITTAL FOR REVIEW/APPROVAL. QUANTITIES OF VARIOUS CONTROL ITEMS SHALL BE FINALIZED ON THE BASIS OF APPROVED SUBMITTAL AND ACCORDINGLY ORDER PLACEMENT SHALL BE DONE BY THE CONTRACTOR.
3. THE CONTRACTOR IS REQUIRED TO SUBMIT WIRING DIAGRAM OF EACH DDC CONTROLLER TO INDICATE CONNECTIVITY OF SENSORS, TRANSDUCERS, SWITCHES AND OTHER FIELD DEVICES, AS PART OF CONTROL SYSTEM SUBMITTAL FOR CONSULTANT'S REVIEW AND APPROVAL.
4. THE COMPLETE SYSTEM SHALL BE INSTALLED, TESTED AND COMMISSIONED BY AUTHORIZED REPRESENTATIVE OF IBMS MANUFACTURER.
5. All SENSORS, FEILD DEVICES, THERMOSTATES, CONTROL VALVE, ACTUATORS, DDC CONTROLLERS, BMS SOFTWARE ETC. SHALL BE, FROM SAME IBMS MANUFACTURER. HOWEVER, ANY SPECIFIC COMPONENT NOT MANUFACTURED BY THAT PRINCIPAL CAN BE OFFERED FROM OTHER RECOMMENDED SOURCES PROVIDED THAT COMPATIBILITY AND AND QUALITY IS ENSURED BY THE CONTRACTOR.
6. IBMS COMPONENTS, INCLUDING ALL DDC CONTROLLERS AND SYSTEMS BEING INTEGRATED WITH IBMS, SHALL BE INTERCONNECTED THROUGH BUILDING LAN WHICH SHALL BE PROVIDED BY COTRACTOR OF ELV/IT WORKS.SAID CONTRACTORS WILL ALSO CONFIGURE VLAN FOR IBMS AS PER PROJECT REQUIREMENT.
7. IBMS COMPONENTS, INCLUDING ALL DDC CONTROLLERS AND SYSTEMS BEING INTEGRATED WITH IBMS, SHALL BE INTERCONNECTED THROUGH BUILDING
8. THE SYSTEMS/ITEMS TO BE INTEGRATED WITH IBMS INCLUDE CHILLERS, HOT WATER GENERATORS, ALARM SYSTEM, WATER FLOW METER FOR CHILLED WATER LINE, POWER ANALYZERS/ENERGY METERS FOR HVAC PLANT ROOM EQUIPMEELEVATORS, POWER GENERATORS, ENERGY MONITORING SYSTEM, FIRE FIGHTING PUMP SET, FIRE NT INCLDUING PUMPS AND COOLING TOWERS.
9. DDC CONTROLLERS FOR POTABLE WATER SYSTEM SHALL BE SUPPLIED TO MONITOR/CONTROL ALL POTABLE WATER PUMPS AND FOR MONITORING OF ALL WATER STORAGE AREAS IN MAIN BUILDING, INCLUDING UNDER GROUND AND OVER HEAD TANKS.
10. FOR ALL FORENSIC lab AREAS WHICH INCORPORATE FUME HOODS, CONTROL CABLING AND CONDUITING FROM RELEVENT AHU'S DDC SHALL BE LAID BY THE CONTRACOR FOR FURTURE CONNECTIVITY.
11. FOR ALL FORENSIC lab AREAS WHICH INCORPORATE FUME HOODS, IMPORTED MODULATING DAMPERS WITH ACTUATORS SHALL BE SUPPLIED BY CONTRACTOR FOR FOR PROPERLY MANAGING EXHAUST AIR FROM THOSE AREAS. TYPICALLY, THOSE LABS ARE SERVED BY AHU NOS. 02, 09 AND 10.
12. DDC CONTROLLERS SHALL BE OFFERED WITH APPROPRIATE I/O POINTS AS PER PROEJCT REQUIREMENTS ALONG WITH SPARE I/O pOINTS FOR FURUTRE PROVISION. USE OF MULTIPLE DDC CONTROLLERS HAVING SMALL I/O POINTS NEEDS TO BE AVOIDED. UNLESS DEEMED EXPANSION I/O MODULES MAY BEDEPLOYED IF DEMED NECESSARY FOR FULFULLING PROJECT/TENDER REQUIREMENTS.
13. All THE DDC CONTROLLRS SHALL HAVE THE CAPISTY TO INTEGRATE THROUGH OPEN PROTOCOL, i.e., BACNET OVER IP, INTO IBMS FOR MONITORING AND CONTROL.
14. FOR SMOKE EXTRACTION, IMPORTED ON/OFF DAMPERS WITH ACTUATORSS SHALL BE SUPPLIED BY THE CONTRACTOR AHU NO. 01 TO AHU NO. 08 AS PER TENDER SPECIFICATIONS/PROJECT REQUIRMENTS. SAID DAMPERS SHALL BE ACTIVATED IN CASE OF FIRE FOR SMOKE EXTRACTION FROM BULDING.
15. THE IBMS SOFTWARE APPLICATION SHALL BE CUSTOMIZED BY THE CONTRACTOR AS PER TENDER SPECIFICATIONS/PROJECT REQUIREMETNS. PRIOR TO DEPLOYMENT AT SITE, THE CONTRACTOR SHALL OFFER THAT SOFTWAE SOLUTION FOR INSPECTON/APPROVAL OF RELEVENT STAKEHOLDER(S).
16. APART FROM PROTOCOL LEVER INTEGRATION OF FIRE ALARM SYSTEM WITH ibms, HARD WIRED CONNECTIVITY OF FIRE ALARM SYSTEM IS NEEDED FOR DDC OF EACH AHU DDC OF SMOKE EXTRACTION FANS AND CONTROLLER OF EACH ELEVATOR. ALL CABLING/CONDUITING AND PROVISION OF RELIABLE SIGNALLING IS INCLUDED IN CONTRACTOR'S SCOPE OF WORK.

16. CONTRACTOR IS ALSO REQUIRED TO INTEGRATE ALL PANELS OF FIRE SUPPRESION SYSTEMS INSTALLED IN THE MAIN FORENSIC BUILDING WITH THE MAIN FIRE ALARM PANEL. ALL CABLING/CONDUITING AND PROVISION OF RELIABLE SIGNALLING IS INCLUDED IN CONTRACTOR'S SCOPE OF WORK.

CONTROL LEGEND:

T:	TEMPERATURE SENSOR
T/F:	TRIP / FAULT STATUS
S/S:	START / STOP COMMAND
DPS:	DIFFERENTIAL PRESSURE SWITCH
S:	SMOKE SENSOR
P:	PRE-FILTER
FAS:	FIRE ALARM SYSTEM
MVD:	MOTORIZED VOLUME DAMPER
H:	HUMIDITY SENSOR
P:	PRESSURE SENSOR
SD:	SMOKE DETECTOR
DXC:	DIRECT EXPANSION COOLING COIL
FA:	FRESH AIR
RA:	RETURN AIR
SA:	SUPPLY AIR
VFD:	VARIABLE FREQUENCY DRIVE
C/S:	CURRENT SWITCH
PF:	PRE-FILTER
BF:	BAG FILTER
CC:	COOLING COIL
PF:	PRE-FILTER

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

HOME DEPARTMENT, GOVERNMENT OF SINDH

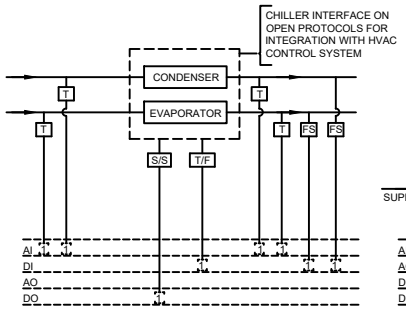
ESTABLISHMENT OF SINDH
FORENSIC SCIENCE LABORATORY KARACHI

LIST OF DRAWING, LEGENDS & GENERAL NOTES

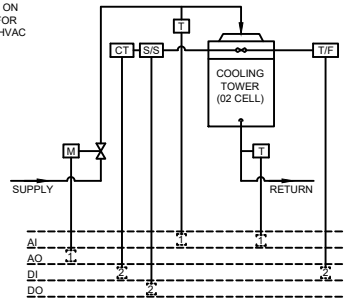
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER/CKD	APPROVED
DWN. Mohsin Rehman			
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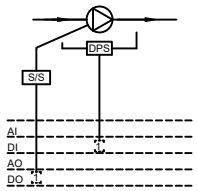
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April, 2025	4268/04 /TD/1J01	0



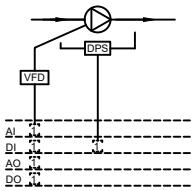
CHILLER (TYPICAL)
SCHEMATIC DIAGRAM



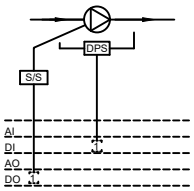
COOLING TOWER TYPICAL (02 CELL)
SCHEMATIC DIAGRAM



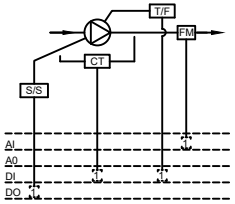
CHILLED WATER PUMP
SCHEMATIC DIAGRAM



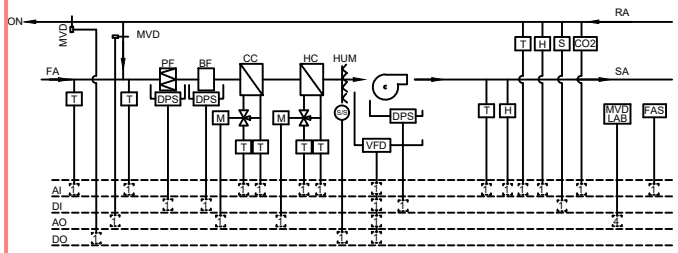
CONDENSER WATER PUMP
SCHEMATIC DIAGRAM



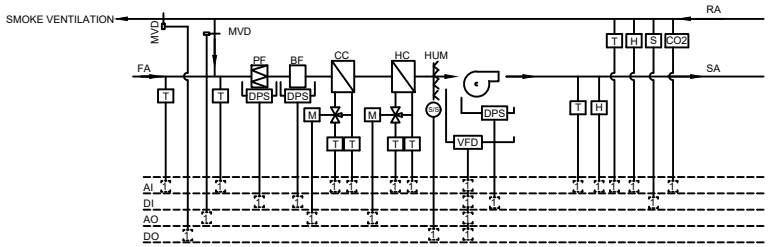
HOT WATER PUMP
SCHEMATIC DIAGRAM



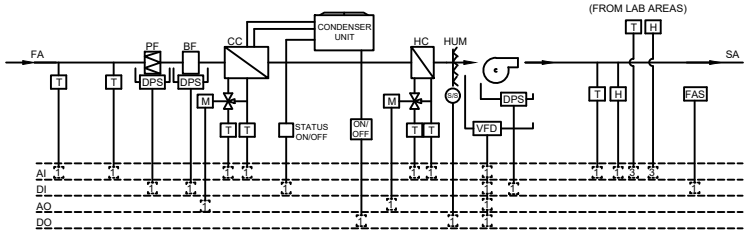
OIL LIFT PUMP
SCHEMATIC DIAGRAM



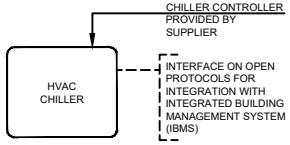
AIR HANDLING UNIT-2 (GROUND FLOOR)
SCHEMATIC DIAGRAM



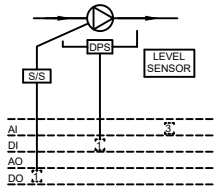
AIR HANDLING UNITS (TYPICAL)
SCHEMATIC DIAGRAM



AIR HANDLING UNIT FOR BSL LABS (TYPICAL)
SCHEMATIC DIAGRAM



HVAC CHILLER
SCHEMATIC DIAGRAM



POTABLE WATER PUMP(TYPICAL)
SCHEMATIC DIAGRAM

NOTES:

1. READ THIS DRAWING IN CONJUNCTION WITH ALL RELEVANT PROJECT DRAWINGS AND TECHNICAL SPECIFICATIONS.
2. THE CONTRACTOR IS REQUIRED TO SUBMIT WIRING DIAGRAM OF EACH DDC CONTROLLER TO INDICATE CONNECTIVITY OF SENSORS, TRANSDUCERS, SWITCHES AND OTHER FIELD DEVICES, AS PART OF INTEGRATED BUILDING MANAGEMENT SYSTEM SUBMITTAL FOR CONSULTANT'S REVIEW AND APPROVAL.
3. THE CONTRACTOR IS REQUIRED TO SUBMIT IBMS SUBMITTAL IN ACCORDANCE WITH THESE SCHEMATICS AND TENDER SPECIFICATION, FOR CONSULTANT'S REVIEW AND APPROVAL.

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

HOME DEPARTMENT, GOVERNMENT OF SINDH

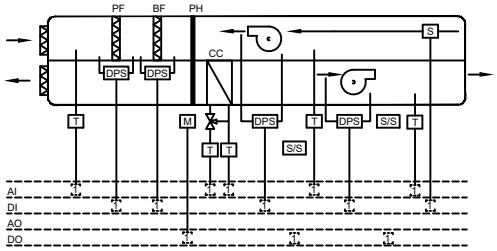
ESTABLISHMENT OF SINDH
FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING

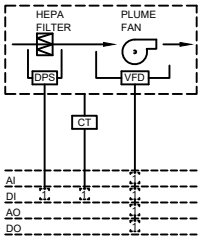
INTEGRATED BUILDING MANAGEMENT SYSTEM
SCHEMATIC DIAGRAM

NATIONAL ENGINEERING SERVICES
PAKISTAN (PVT) LIMITED, KARACHI

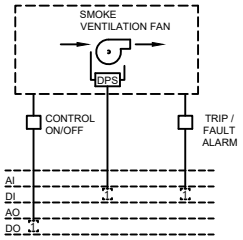
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FILE.			
CKD.	DATE April, 2025	DRAWING NO. 4268/04/TD/1J02	REV. /0\
SUBM.			



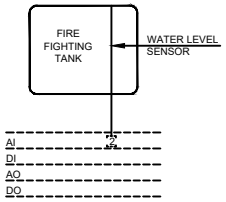
ENERGY RECOVERY VENTILATOR
SCHEMATIC DIAGRAM



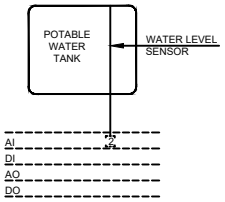
PLUME FAN (TYPICAL)
SCHEMATIC DIAGRAM



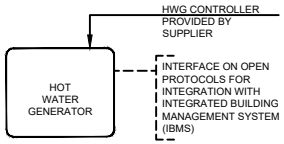
SMOKE VENTILATION FAN (TYPICAL)
SCHEMATIC DIAGRAM



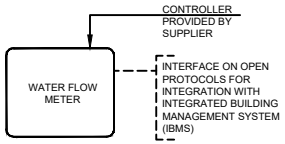
FIRE FIGHTING TANK
SCHEMATIC DIAGRAM



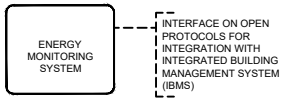
POTABLE WATER TANK
SCHEMATIC DIAGRAM



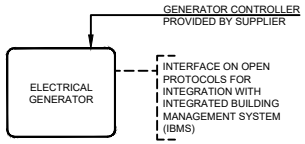
HOT WATER GENERATOR
SCHEMATIC DIAGRAM



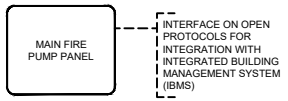
WATER FLOW METER
(FOR CHILLED WATER MAIN LINE
& SECONDARY WATER LINES)
SCHEMATIC DIAGRAM



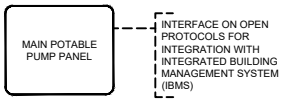
ENERGY MONITORING
SYSTEM SCHEMATIC
DIAGRAM



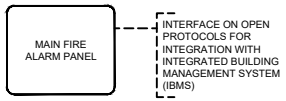
GENERATORS
(GEN SETS)
SCHEMATIC DIAGRAM



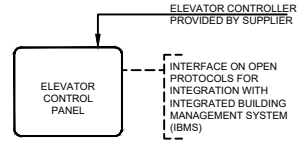
FIRE FIGHTING
SYSTEM
SCHEMATIC DIAGRAM



POTABLE WATER
SYSTEM
SCHEMATIC DIAGRAM



FIRE ALARM
SYSTEM
SCHEMATIC DIAGRAM



ELEVATORS
SCHEMATIC DIAGRAM

NOTES:

1. READ THIS DRAWING IN CONJUNCTION WITH ALL RELEVANT PROJECT DRAWINGS AND TECHNICAL SPECIFICATIONS.
2. THE CONTRACTOR IS REQUIRED TO SUBMIT WIRING DIAGRAM OF EACH DDC CONTROLLER TO INDICATE CONNECTIVITY OF SENSORS, TRANSDUCERS, SWITCHES AND OTHER FIELD DEVICES, AS PART OF INTEGRATED BUILDING MANAGEMENT SYSTEM SUBMITTAL FOR CONSULTANT'S REVIEW AND APPROVAL.
3. THE CONTRACTOR IS REQUIRED TO SUBMIT IBMS SUBMITTAL IN ACCORDANCE WITH THESE SCHEMATICS AND TENDER SPECIFICATION, FOR CONSULTANT'S REVIEW AND APPROVAL.

HOME DEPARTMENT, GOVERNMENT OF SINDH

ESTABLISHMENT OF SINDH
FORENSIC SCIENCE LABORATORY KARACHI

MAIN BUILDING

INTEGRATED BUILDING MANAGEMENT SYSTEM
SCHEMATIC DIAGRAM

NATIONAL ENGINEERING SERVICES
PAKISTAN (PVT) LIMITED, KARACHI

REFERENCE DRAWINGS		REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.			

DESN. NESPAK	RECOMMENDED	VER/CKD	APPROVED
DWN. Mohsin Rehman			
FILE.			
CKD.			
SUBM.			

DATE	DRAWING NO.	REV.
April, 2025	4268/04/TD/1J03	A

HOME DEPARTMENT
GOVERNMENT OF
SINDH

ESTABLISHMENT OF SINDH FORENSIC
SCIENCE LABORATORY KARACHI

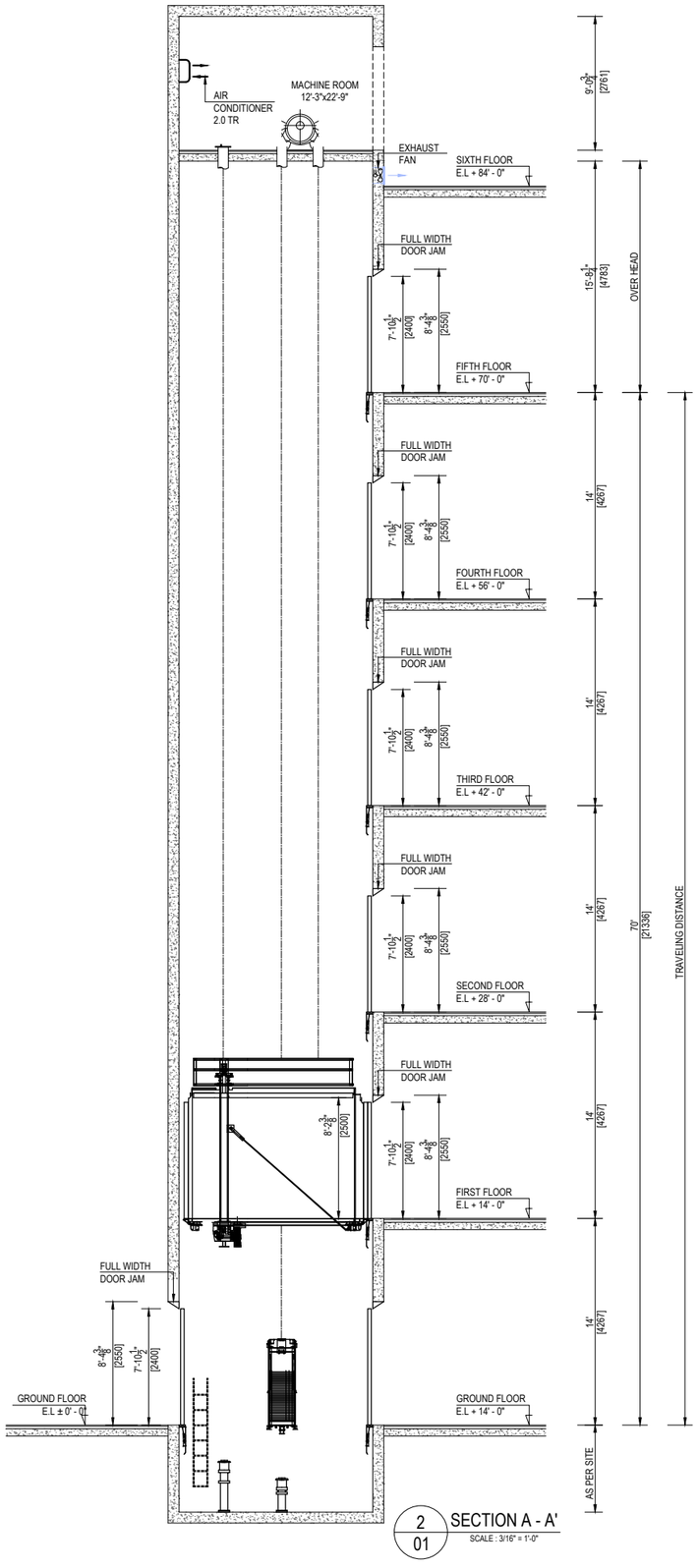
MAIN BUILDING

CARGO ELEVATOR

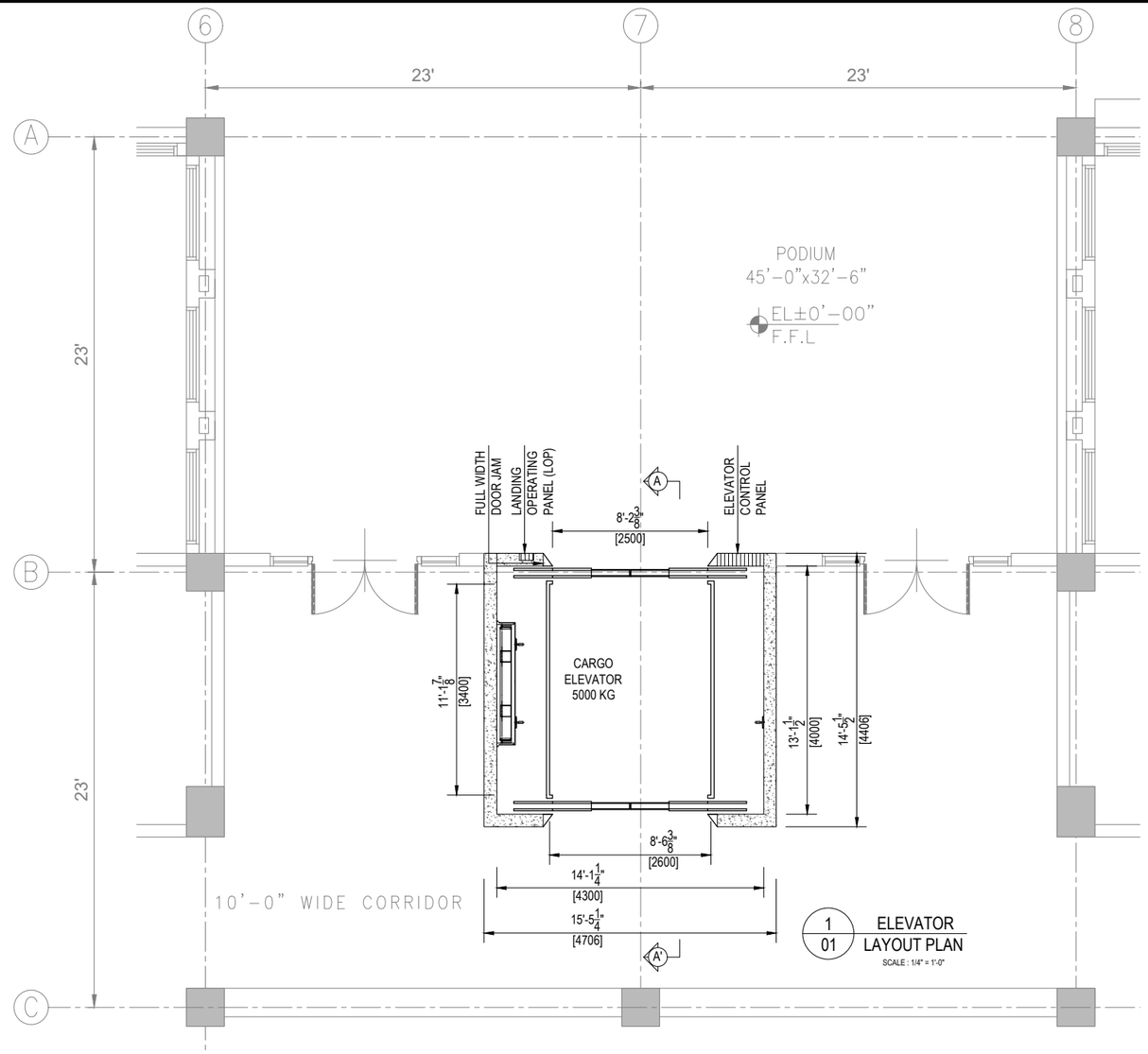
TENDER DRAWINGS

APRIL, 2025

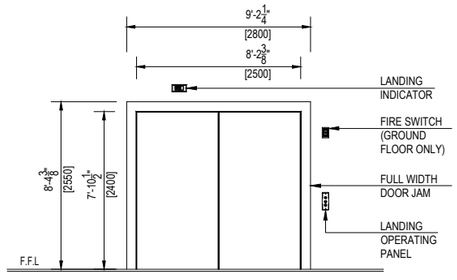
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED
13th Floor, N.I.C. Building, Abbasi Shaheed Road, Off. Shahrah-e-Faisal, Karachi
PABX:+92-21-99090000 Fax : +92-21-35651994, 99225366
E-mail : karachi@nespak.com.pk, Website: www.nespak.com.pk



2 / 01 SECTION A - A'
SCALE : 3/16" = 1'-0"



1 / 01 ELEVATOR LAYOUT PLAN
SCALE : 1/4" = 1'-0"



3 / 01 DOOR ELEVATION
SCALE : 1/4" = 1'-0"

NOTES:

1. ALL DIMENSIONS ARE IN INCHES (MM) UNLESS OTHERWISE STATED.
2. ESTIMATED ELECTRIC CONSUMPTION IS 35 KW.
3. THE CARGO ELEVATOR IS MACHINE ROOM SIMPLEX THROUGH TYPE.
4. ELEVATOR EQUIPMENT INCLUDING BUFFERS, MACHINERY. ETC. SHOWN IN THIS DRAWING ARE FOR REFERENCE ONLY.
5. ALL THE PROVISIONS AND ADJUSTMENTS REQUIRED FOR INCORPORATION OF PROPOSED REQUIREMENTS SHALL BE CHECKED AND PROVIDED BY THE RELEVANT SPECIALITY.

ELEVATOR SCHEDULE

NO.	ELEVATOR ID	DESCRIPTION	CAPACITY (kg.)	SPEED (m/sec)	NO. OF STOPS/ OPENING	CAR FINISHES			CAR SIZE (WxDxH) INCHES (MM)	DOOR (WxH) INCHES (MM)
						FLOOR	WALL	CEILING		
1.	CARGO ELEVATOR / FREIGHT	MACHINE ROOM (SIMPLEX THROUGH TYPE)	5000	0.50 ~ 1.00	06 / 07	AS PER ENGINEER'S APPROVAL	AS PER ENGINEER'S APPROVAL	AS PER ENGINEER'S APPROVAL	8'-6⅜"x11'-1⅞" x8'-2⅜" (2600x3400 x2500)	8'-2⅜"x7'-10½" (2500x2400) 4 - PANEL CENTRAL OPENING STAINLESS STEEL

CLIENT:-

HOME DEPARTMENT,
GOVERNMENT OF SINDH

CONSULTANT:-

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
ARCHITECTURE & PLANNING DIVISION KARACHI.
4th Floor, N.I.C. Building, Abbasi Shaheed Road, Karachi,
Tel: 99225430-34

REV.	DATE	DESCRIPTION	APPROVED		
04				DRAWN	M.TOQEER
03				SUBMITTED	
02				RECOMMENDED	
01	---	---		CHD./VER.	
				APPROVED	

PROJECT:-

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

DRAWING TITLE :- **MAIN BUILDING ELEVATOR LAYOUT PLAN AND SECTIONAL DETAIL (5000 KG)**

SCALE:- AS SHOWN

DATE:- APRIL, 2025

DRAWING No:- **4268/04/TD/J01**

REV. 0

Y:\UMAIR BABER\ASAD RIAZ\SFSL-CARGO ELEVATOR 24-04-2025\SFSL-CARGO ELEVATOR 24-04-2025\DRAWING-CARGO ELEVATOR.DWG

LIST OF DRAWING

SR. #	DRAWING NO.	TITLE
		GENERAL DRAWINGS
1	4268/04/TD/E000	LIST OF DRAWING
2	4268/04/TD/E001	GENERAL NOTES
		SCHEMATIC DIAGRAMS
3	4268/04/TD/E002	ADDRESSABLE FIRE ALARM SYSTEM SCHEMATIC DIAGRAM
4	4268/04/TD/E003	PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC DIAGRAM
		PERIMETER INTRUSION DETECTION SYSTEM (PIDS)
5	4268/04/TD/E004	MASTER PLAN
		ADDRESSABLE FIRE ALARM SYSTEM LAYOUT DRAWINGS
6	4268/04/TD/1E101	MAIN BUILDING BASEMENT FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
7	4268/04/TD/1E102	MAIN BUILDING GROUND FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
8	4268/04/TD/1E103	MAIN BUILDING FIRST FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
9	4268/04/TD/1E104	MAIN BUILDING SECOND FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
10	4268/04/TD/1E105	MAIN BUILDING THIRD FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
11	4268/04/TD/1E106	MAIN BUILDING ROOF ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
12	4268/04/TD/2E201	EVIDENCE COLLECTION BLOCK BASEMENT FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
13	4268/04/TD/2E202	EVIDENCE COLLECTION BLOCK GROUND FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
14	4268/04/TD/2E203	EVIDENCE COLLECTION BLOCK FIRST FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
15	4268/04/TD/2E204	EVIDENCE COLLECTION BLOCK ROOF ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
16	4268/04/TD/3E301	RECEPTION BLOCK GROUND FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
17	4268/04/TD/3E302	RECEPTION BLOCK FIRST FLOOR ADDRESSABLE FIRE ALARM SYSTEM LAYOUT
18	4268/04/TD/3E303	RECEPTION BLOCK ROOF ADDRESSABLE FIRE ALARM SYSTEM LAYOUT

LIST OF DRAWING

		PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT DRAWINGS
19	4268/04/TD/1E107	MAIN BUILDING BASEMENT FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
20	4268/04/TD/1E108	MAIN BUILDING GROUND FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
21	4268/04/TD/1E109	MAIN BUILDING FIRST FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
22	4268/04/TD/1E110	MAIN BUILDING SECOND FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
23	4268/04/TD/1E111	MAIN BUILDING THIRD FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
24	4268/04/TD/1E112	MAIN BUILDING ROOF PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
25	4268/04/TD/2E205	EVIDENCE COLLECTION BLOCK BASEMENT FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
26	4268/04/TD/2E206	EVIDENCE COLLECTION BLOCK GROUND FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
27	4268/04/TD/2E207	EVIDENCE COLLECTION BLOCK FIRST FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
28	4268/04/TD/2E208	EVIDENCE COLLECTION BLOCK ROOF PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
29	4268/04/TD/3E304	RECEPTION BLOCK GROUND FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
30	4268/04/TD/3E305	RECEPTION BLOCK FIRST FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
31	4268/04/TD/3E306	RECEPTION BLOCK ROOF PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT
		CCTV, LOCAL AREA NETWORK, WLAN, VIDEO CONFERENCE,EMPLOYEE ATTENDANCE, ACCESS CONTROL & WALK THROUGH GATE, UVSS, BAGGAGE SCANNING
32	4268/04/TD/1IT101	MAIN BUILDING BASEMENT FLOOR CCTV, LOCAL AREA NETWORK, WLAN, VIDEO CONFERENCE,EMPLOYEE ATTENDANCE, ACCESS CONTROL & WALK THROUGH GATE,BAGGAGE SCANNING
33	4268/04/TD/1IT102	MAIN BUILDING GROUND FLOOR CCTV, LOCAL AREA NETWORK, WLAN, VIDEO CONFERENCE,EMPLOYEE ATTENDANCE, ACCESS CONTROL & WALK THROUGH GATE,BAGGAGE SCANNING
34	4268/04/TD/1IT103	MAIN BUILDING FIRST FLOOR CCTV, LOCAL AREA NETWORK, WLAN, VIDEO CONFERENCE,EMPLOYEE ATTENDANCE, ACCESS CONTROL & WALK THROUGH GATE,BAGGAGE SCANNING
35	4268/04/TD/1IT104	MAIN BUILDING SECOND FLOOR CCTV, LOCAL AREA NETWORK, WLAN, VIDEO CONFERENCE,EMPLOYEE ATTENDANCE, ACCESS CONTROL & WALK THROUGH GATE,BAGGAGE SCANNING
35	4268/04/TD/1IT105	MAIN BUILDING THIRD FLOOR CCTV, LOCAL AREA NETWORK, WLAN, VIDEO CONFERENCE,EMPLOYEE ATTENDANCE, ACCESS CONTROL & WALK THROUGH GATE,BAGGAGE SCANNING
37	4268/04/TD/1IT106	MAIN BUILDING ROOF CCTV, LOCAL AREA NETWORK, WLAN, VIDEO CONFERENCE,EMPLOYEE ATTENDANCE, ACCESS CONTROL & WALK THROUGH GATE,BAGGAGE SCANNING

CLIENT

HOME DEPARTMENT,
GOVERNMENT OF SINDH

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.

HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N,
MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	SA
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT

ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

LIST OF DRAWINGS

DATE: APRIL, 2025

DRAWING No.: 4268/04/TD/E000

SCALE

REV.: 0



GENERAL NOTES:

1– THE WORD COMMUNICATION IN THESE DRAWINGS REFER TO FIRE ALARM, PUBLIC ADDRESS, AND PERIMETER INTRUSION DETECTION SYSTEM.

2– CO–ORDINATE AT SITE WITH OTHER SERVICES FOR EXACT LOCATION AND POSITION OF CONDUITS AND COMMUNICATION EQUIPMENT/DEVICES.

3– ALL COMMUNICATION DRAWINGS SHALL BE READ IN CONJUNCTION WITH SPECIFICATIONS, BOQ, ARCHITECTURE, ELECTRICAL, STRUCTURE, HVAC, PLUMBING DRAWINGS AND ALL OTHER RELEVANT DETAILS.

4– DIMENSIONS/MEASUREMENTS GIVEN IN LAYOUTS ARE APPROXIMATE. THE CONTRACTOR SHALL BE RESPONSIBLE TO CALCULATE ACTUAL DIMENSIONS/MEASUREMENTS ACCORDING TO STRUCTURE AND ARCHITECTURE DRAWINGS.

5– THE ROUTES OF EXTERNAL CABLE AND PIPES SHALL BE FOLLOWED AS SHOWN ON THE DRAWING, ANY CHANGE IN ROUTES REQUIRED DUE TO SITE CONDITIONS SHALL BE MADE IN CO–ORDINATION WITH OTHER SERVICES, AFTER OBTAINING ENGINEER'S APPROVAL

6– WHERE CABLES ENTER BUILDINGS, THESE SHALL BE LAID IN PROTECTIVE PIPES. HAND HOLE SHALL BE PROVIDED OUTSIDE THE BUILDING.

7– ALL UNDERGROUND PIPES SHALL BE LAID MINIMUM 1.5 FEET BELOW THE TOP OF PAVEMENT THE DEPTH MAY BE INCREASED / DECREASED DUE TO THE SITE CONDITIONS AFTER OBTAINING ENGINEERS APPROVAL

8– ALL UNDERGROUND PIPES, MAN HOLES & HANDHOLES SHALL BE PROPERLY SEALED WATER TIGHT AT ENDS/JOINTS AFTER INSTALLATION.

9– SPARE PIPES SHALL HAVE THEIR ENDS PROPERLY PLUGGED WITH CAP AND MADE WATER TIGHT. BOTH ENDS OF PIPES SHALL BE MARKED BY PIPE END MARKERS FOR IDENTIFICATION.

10– CABLE MARKERS SHALL BE PROVIDED AT 30 METER INTERVALS ALONG STRAIGHT RUNS OF CABLE DUCT / ROUTE AND AT EACH BEND.

11– ALL ROUTING OF PIPES, PIPE DUCTS & CONNECTION DETAILS SHALL BE CARRIED OUT WITH THE APPROVAL OF THE ENGINEER.

12– MANUFACTURER'S RECOMMENDATION SHALL BE FOLLOWED FOR INSTALLATION OF ALL COMMUNICATION SYSTEMS.

13– THE CONTRACTOR SHALL TAKE THE RESPONSIBILITIES OF GENERAL INTEGRATOR FOR ALL THE SUB–SYSTEMS AND EQUIPMENT WITHIN THE SCOPE OF WORK INCLUDING INTERFACES WITH OTHER SYSTEMS.

14– ALL COMMUNICATION SYSTEMS SHALL BE FED FROM UNINTERRUPTED POWER SUPPLY (UPS).

15– MOUNTING HEIGHT OF FOLLOWING DEVICES SHALL BE INSTALLED AT THE INDICATED HEIGHT FROM FINISHED FLOOR LEVEL (F.F.L) TO THE BOTTOM OF DEVICE UNLESS OTHERWISE MENTIONED OR INSTRUCTED:

- ADDRESSABLE FIRE ALARM CONTROL PANEL---------- 56INCH
- ADDRESSABLE CONTROL/MONITOR MODULE---------- 87INCH/AS PER SITE
- ADDRESSABLE MANUAL CALL POINT---------- 56INCH
- ADDRESSABLE BEAM DETECTOR / ---------- 336INCH/ AS PER SITE
- ADDRESSABLE SOUNDER / ---------- 87INCH/ AS PER SITE
- HORN SPEAKER / ---------- 156INCH/ AS PER SITE
- MICRO PHONE SOCKET OUTLET---------- 10INCH/ AS PER SITE
- WEATHER PROOF ENCLOSURE----------AS PER SITE

16– COLOUR, SHAPE & MOUNTING HEIGHT OF MICROPHONE SOCKET OUTLETS SHALL MATCH WITH ELECTRICAL AND TELECOMMUNICATION SOCKET OUTLET

17– DETECTORS SHALL BE INSTALLED 1 FEET AWAY FROM ANY PART OF ANY LIGHT FIXTURE AND 3 FEET AWAY FROM DIFFUSER OF HVAC SYSTEM.

18– WHERE MANUAL CALL POINT AND SOUNDER ARE SHOWN SIDE BY SIDE THEY SHALL BE INSTALLED IN SAME VERTICAL LINE.

19– CONTRACTOR SHALL SUBMIT SOUND PRESSURE LEVEL (SPL) CALCULATION OF SPEAKERS ON THE LAYOUT DRAWINGS OF SINDH FORENRIC SCIENCE LAB FOR REVIEW AND APPROVAL OF ENGINEER.

20– IN PARKING AREA HORN SPEAKERS SHALL BE PLACED ON THE WALL/COLUMN AS PER SITE.

21– CONTRACTOR SHALL SUBMIT CO–ORDINATION SHOP DRAWING OF COMMUNICATION SYSTEM LAYOUT WITH POWER LAYOUT BEFORE EXECUTION OF WORKS.

22– CONTRACTOR SHALL CO–ORDINATE WITH HVAC LAYOUT FOR PLACEMENT OF RACKS IN COMMAND AND CONTROL ROOM/COMMUNICATION EQUIPMENT ROOM.

23– CONTRACTOR SHALL CO–ORDINATE WITH FIRE FIGHTING LAYOUT FOR PLACEMENT OF MONITOR MODULE IN DATA CENTER.

CABLE SCHEDULE

Ⓐ 2 CORE 1.5 Sq.mm (120 min) FIRE RESISTANT ENHANCED LSZH CABLE COMPLYING BS 5839, BS 6387, EN50200. BS 8434–2:2003 + A2:200 / MANUFACTURER'S RECOMMENDED CABLE

Ⓑ 2 CORE 2.5 Sq.mm (120 min) FIRE RESISTANT ENHANCED LSZH CABLE COMPLYING BS 5839, BS 6387, EN50200, BS 8434–2:2003 + A2:200 CABLE / MANUFACTURER'S RECOMMENDED CABLE

Ⓒ MANUFACTURER'S RECOMMENDED CABLE

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

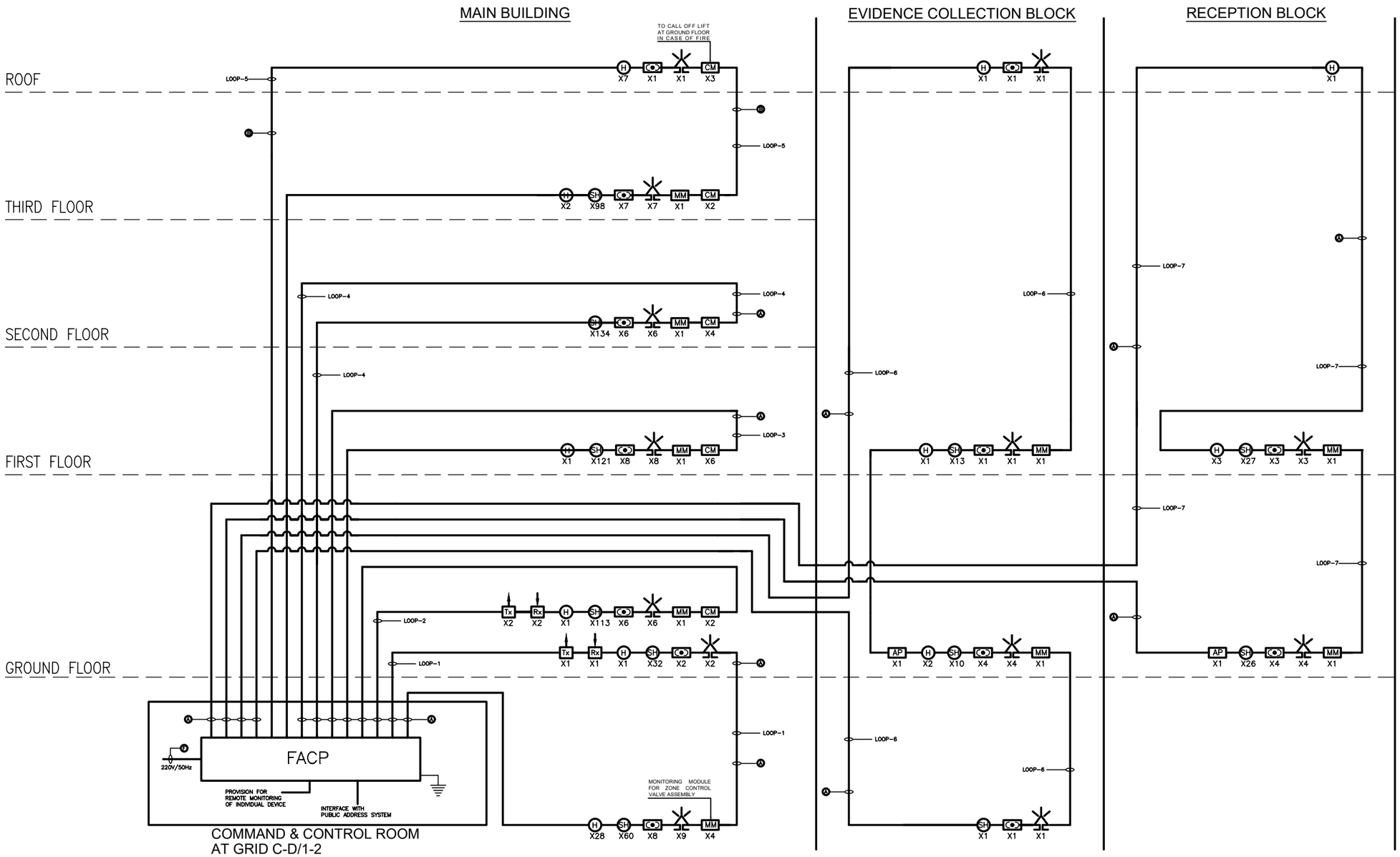
CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: GENERAL NOTES

CONSULTANT: NESPAK NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED	
DWN. SA				
CKD.	DATE APRIL, 2025	DRAWING NO. 4268/04/TD/001	SCALE 3/64"=1'–0"	REV. A
SUBM.				



NOTES:-

1. FOR LEGEND REFER LAYOUT DRAWINGS.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/TD/E001
3. FOR EXTERNAL CONNECTIVITY OF FIRE ALARM NETWORK LAYOUT REFER DRAWING NO. 4268/04/TD/4IT114

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

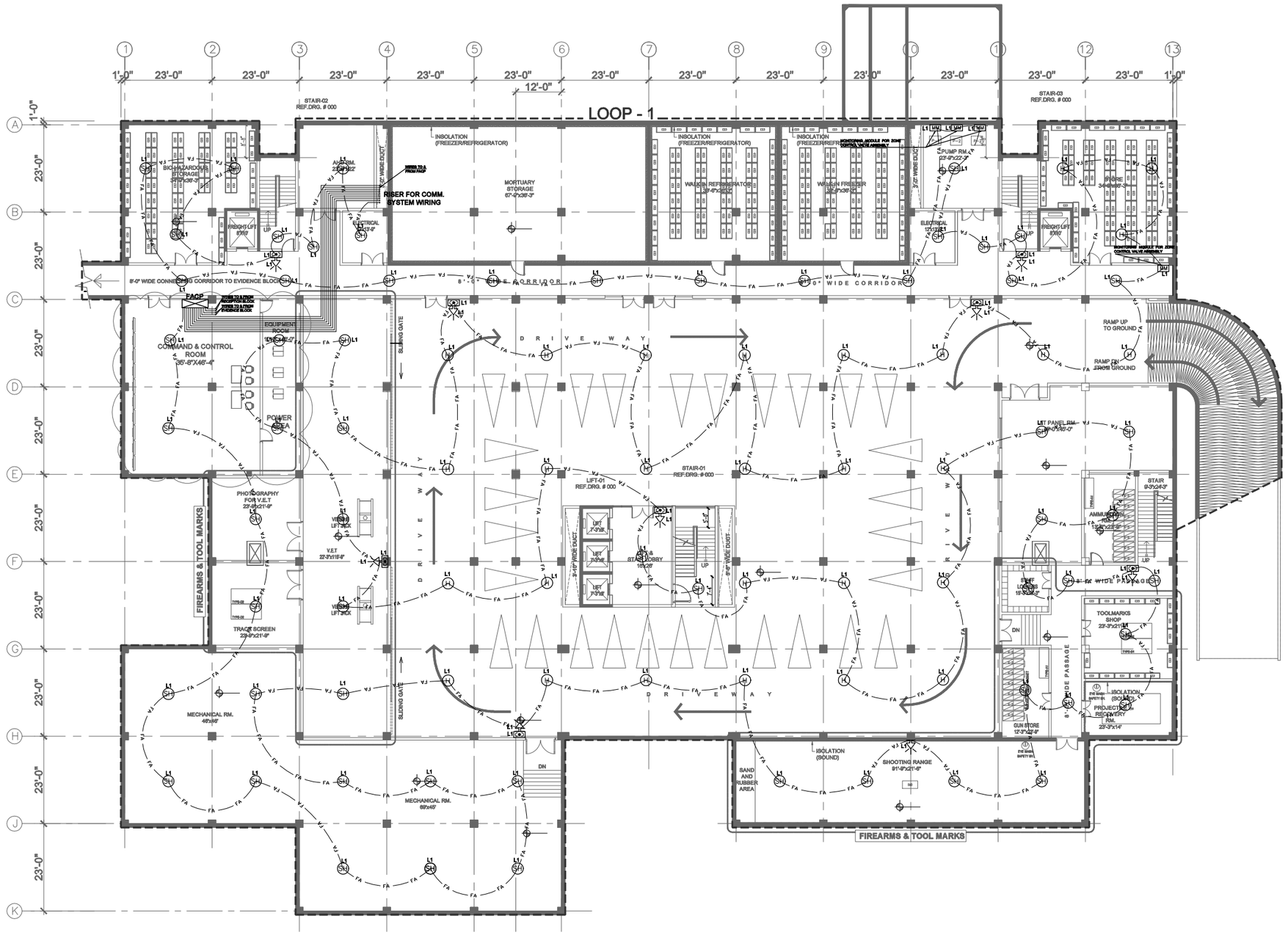
CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
ROOF TOP
ADDRESSABLE FIRE ALARM SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED	
DWN. SA				
CKD.	DATE	DRAWING NO.	SCALE	REV.
SUBM.	APRIL, 2025	4268/04/TD/E002	3/63"=1'-0"	A





NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/TD/E001
3. FOR

   DRAWING NO. 4268/04/TD/E002

LEGEND:-

SYMBOL	DESCRIPTION
SH	INTELLIGENT ADDRESSABLE LOOP POWERED OPTICAL SMOKE & HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
H	INTELLIGENT ADDRESSABLE LOOP POWERED HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
Tx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (TRANSMITTER)
Rx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (RECEIVER)
	ADDRESSABLE LOOP POWERED MANUAL CALL POINT WITH BASE & BUILT-IN ISOLATOR.
	ADDRESSABLE LOOP POWERED AUDIO VISUAL SOUNDER WITH BASE BUILT-IN ISOLATOR.
CM	ADDRESSABLE LOOP POWERED CONTROL/OUTPUT MODULE
MM	ADDRESSABLE LOOP POWERED MONITOR/INPUT MODULE
FACP	INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL WITH BACKUP BATTERIES, BATTERIES CHARGER & NETWORK CARD COMPLETE IN ALL RESPECT
AP	ADRESSABLE FIRE ALARM REPEATER/ANNUNCIATION PANEL INCLUDING ALL MOUNTING AND INSTALLATION ACCESSORIES.



COVERED AREA = 53,655 Sq.Ft.

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

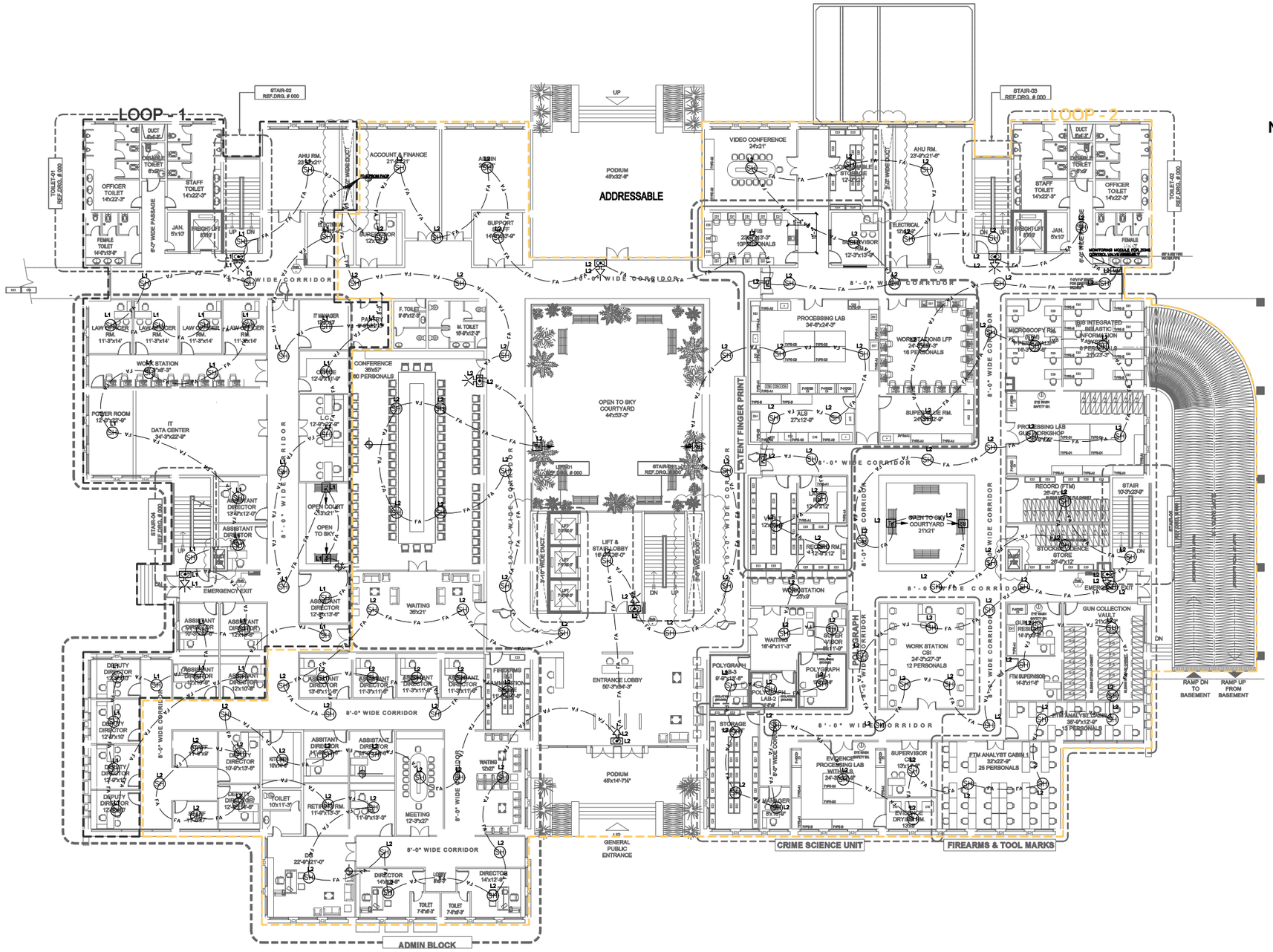
CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
BASEMENT FLOOR
ADDRESSABLE FIRE ALARM SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED	
DWN. SA				
CKD.				
SUBM.	DATE	DRAWING NO.	SCALE	REV.
	APRIL, 2025	4268/04/TD/1E101	N.T.S.	A



NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/TD/E001
3. FOR
   DRAWING NO. 4268/04/TD/E002
4. BEAM
   FROM
   AT ALL TIME.

LEGEND:-

SYMBOL	DESCRIPTION
SH	INTELLIGENT ADDRESSABLE LOOP POWERED OPTICAL SMOKE & HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
H	INTELLIGENT ADDRESSABLE LOOP POWERED HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
Tx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (TRANSMITTER)
Rx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (RECEIVER)
	ADDRESSABLE LOOP POWERED MANUAL CALL POINT WITH BASE & BUILT-IN ISOLATOR.
	ADDRESSABLE LOOP POWERED AUDIO VISUAL SOUNDER WITH BASE BUILT-IN ISOLATOR.
CM	ADDRESSABLE LOOP POWERED CONTROL/OUTPUT MODULE
MM	ADDRESSABLE LOOP POWERED MONITOR/INPUT MODULE
FACP	INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL WITH BACKUP BATTERIES, BATTERIES CHARGER & NETWORK CARD COMPLETE IN ALL RESPECT
AP	ADRESSABLE FIRE ALARM REPEATER/ANNUNCIATION PANEL INCLUDING ALL MOUNTING AND INSTALLATION ACCESSORIES.

COVERED AREA = 45,798 Sq.Ft.

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

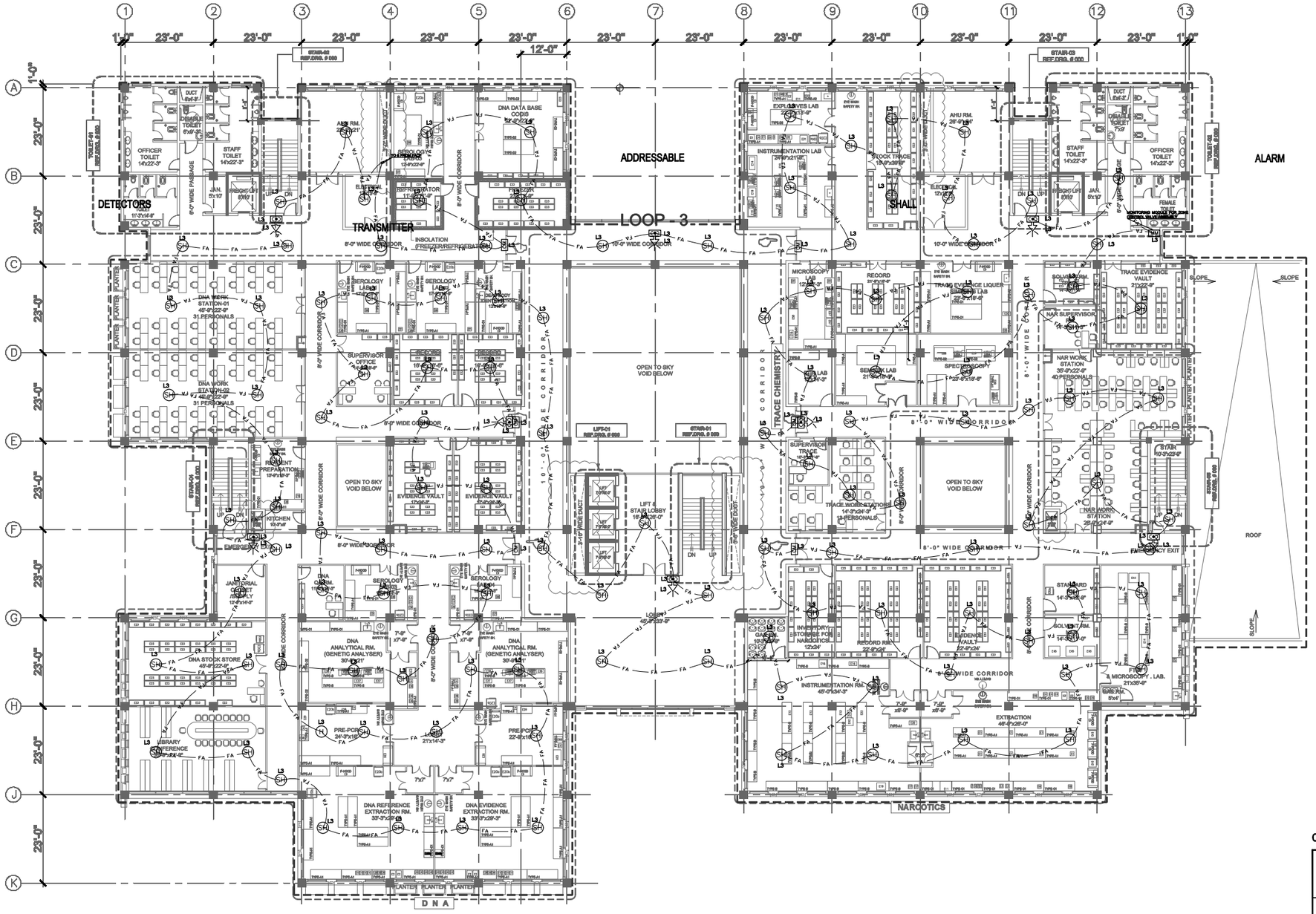
CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
GROUND FLOOR
ADDRESSABLE FIRE ALARM SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN. SA			
CKD.	DATE	DRAWING NO.	SCALE / REV.
SUBM.	APRIL, 2025	4268/04/TD/1E102	3/63"=1'-0" / A



NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/TD/E001
3. FOR DRAWING NO.- 4268/04/TD/E002

LEGEND:-

SYMBOL	DESCRIPTION
SH	INTELLIGENT ADDRESSABLE LOOP POWERED OPTICAL SMOKE & HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
H	INTELLIGENT ADDRESSABLE LOOP POWERED HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
Tx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (TRANSMITTER)
Rx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (RECEIVER)
	ADDRESSABLE LOOP POWERED MANUAL CALL POINT WITH BASE & BUILT-IN ISOLATOR.
	ADDRESSABLE LOOP POWERED AUDIO VISUAL SOUNDER WITH BASE BUILT-IN ISOLATOR.
CM	ADDRESSABLE LOOP POWERED CONTROL/OUTPUT MODULE
MM	ADDRESSABLE LOOP POWERED MONITOR/INPUT MODULE
FACP	INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL WITH BACKUP BATTERIES, BATTERIES CHARGER & NETWORK CARD COMPLETE IN ALL RESPECT
AP	ADRESSABLE FIRE ALARM REPEATER/ANNUNCIATION PANEL INCLUDING ALL MOUNTING AND INSTALLATION ACCESSORIES.

COVERED AREA = 45,798 Sq.Ft.

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

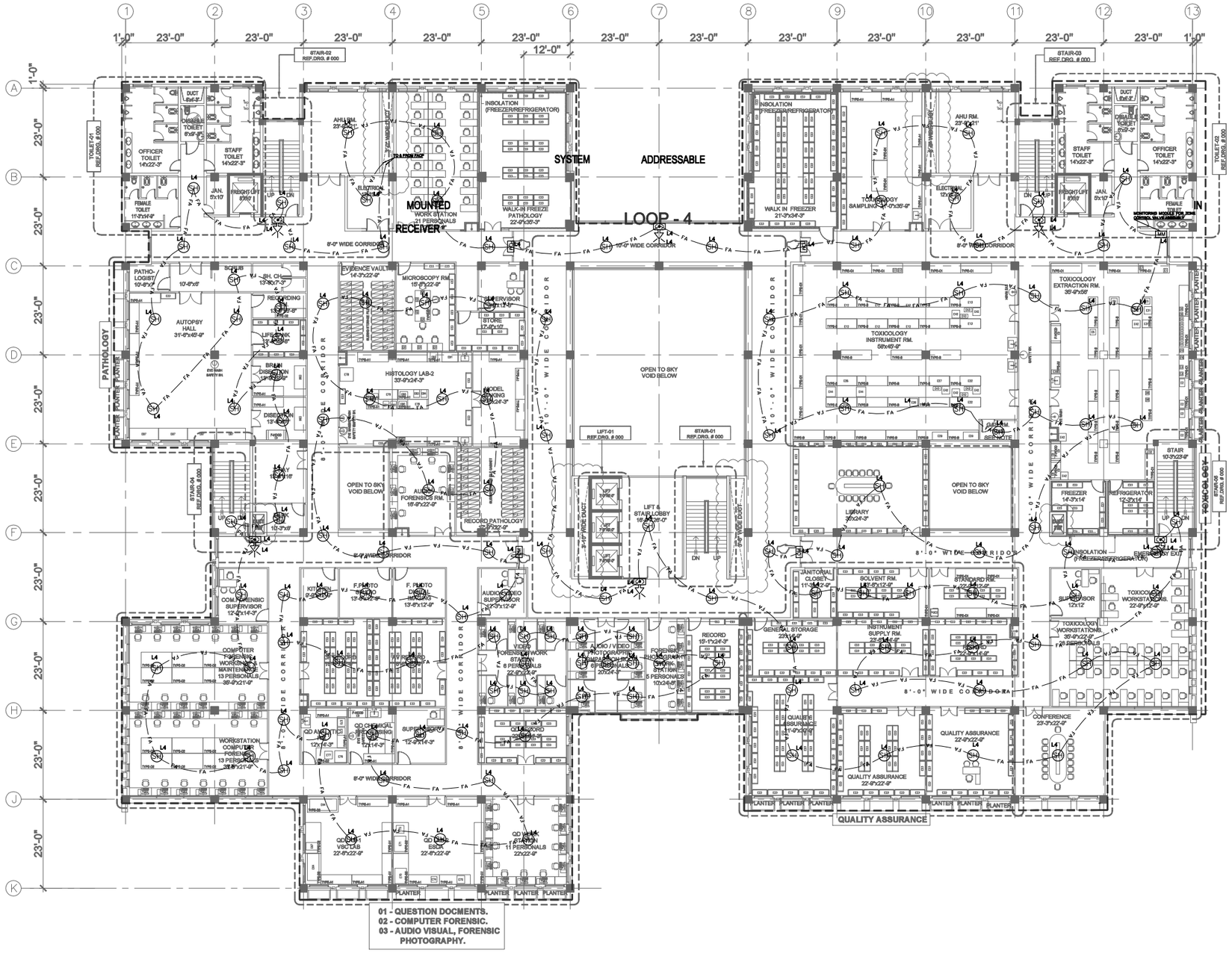
CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
FIRST FLOOR
ADDRESSABLE FIRE ALARM SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN. SA			
CKD.	DATE	DRAWING NO.	SCALE / REV.
SUBM.	APRIL, 2025	4268/04/TD/1E103	3/63"=1'-0" / A



NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/TD/E001
3. FOR DRAWING NO. 4268/04/TD/E002 SHALL

LEGEND:-

SYMBOL	DESCRIPTION
SH	INTELLIGENT ADDRESSABLE LOOP POWERED OPTICAL SMOKE & HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
H	INTELLIGENT ADDRESSABLE LOOP POWERED HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
Tx →	ADDRESSABLE LOOP POWERED BEAM DETECTOR (TRANSMITTER)
Rx ←	ADDRESSABLE LOOP POWERED BEAM DETECTOR (RECEIVER)
	ADDRESSABLE LOOP POWERED MANUAL CALL POINT WITH BASE & BUILT-IN ISOLATOR.
	ADDRESSABLE LOOP POWERED AUDIO VISUAL SOUNDER WITH BASE BUILT-IN ISOLATOR.
CM	ADDRESSABLE LOOP POWERED CONTROL/OUTPUT MODULE
MM	ADDRESSABLE LOOP POWERED MONITOR/INPUT MODULE
FACP	INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL WITH BACKUP BATTERIES, BATTERIES CHARGER & NETWORK CARD COMPLETE IN ALL RESPECT
AP	ADRESSABLE FIRE ALARM REPEATER/ANNUNCIATION PANEL INCLUDING ALL MOUNTING AND INSTALLATION ACCESSORIES.

COVERED AREA = 45,798 Sq.Ft.

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

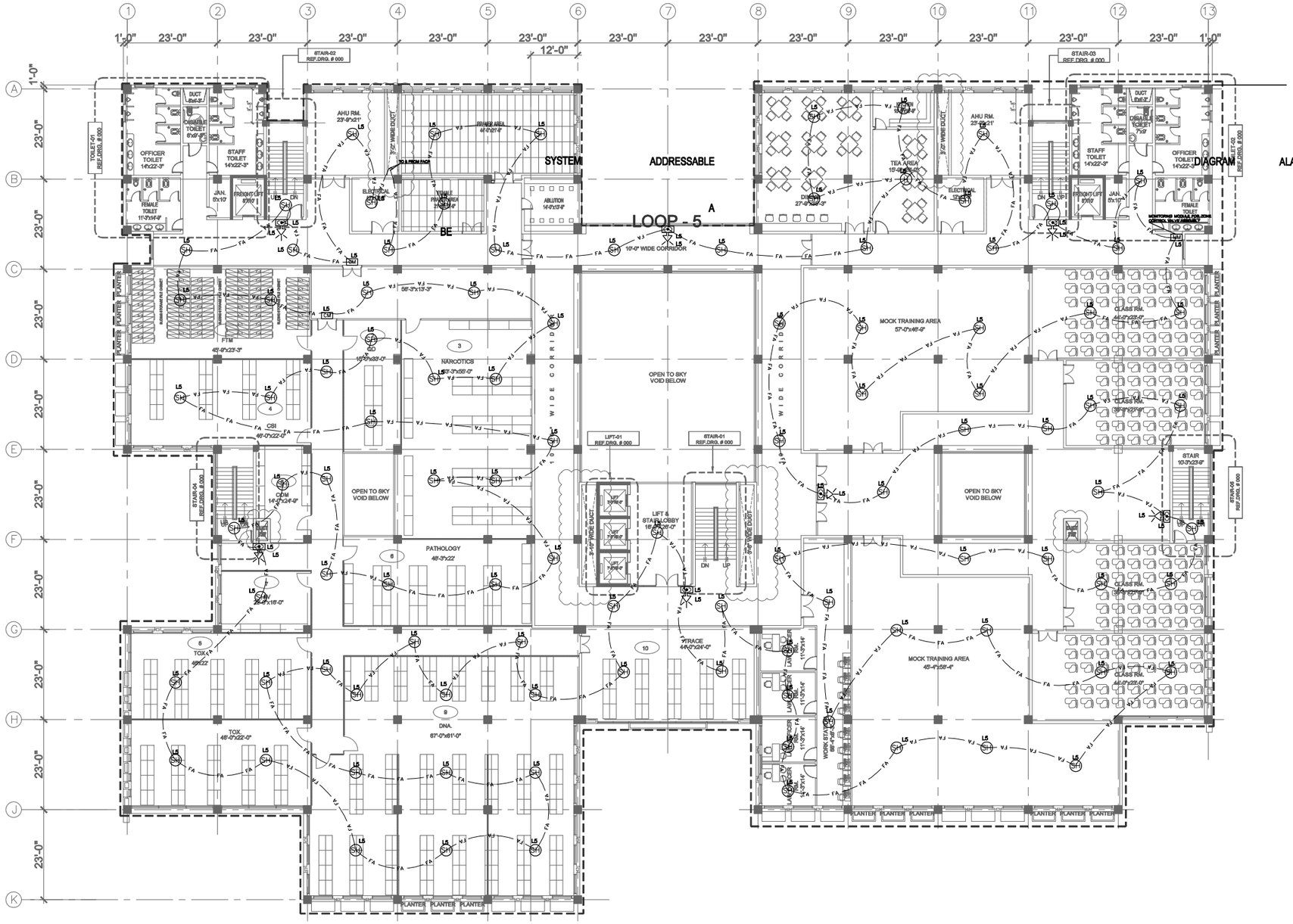
CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
SECOND FLOOR
ADDRESSABLE FIRE ALARM SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED	
DWN. SA				
CKD.	DATE	DRAWING NO.	SCALE	REV.
SUBM.	APRIL, 2025	4268/04/TD/1E104	3/63"=1'-0"	A



SCHEMATIC FIRE ALARM SYSTEM DIAGRAM

SUCH ADDRESSABLE WAY

BE CLEAR

NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/TD/E001
3. FOR DRAWING NO. 4268/04/TD/E002

LEGEND:-

SYMBOL	DESCRIPTION
SH	INTELLIGENT ADDRESSABLE LOOP POWERED OPTICAL SMOKE & HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
H	INTELLIGENT ADDRESSABLE LOOP POWERED HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
Tx →	ADDRESSABLE LOOP POWERED BEAM DETECTOR (TRANSMITTER)
Rx ←	ADDRESSABLE LOOP POWERED BEAM DETECTOR (RECEIVER)
	ADDRESSABLE LOOP POWERED MANUAL CALL POINT WITH BASE & BUILT-IN ISOLATOR.
	ADDRESSABLE LOOP POWERED AUDIO VISUAL SOUNDER WITH BASE BUILT-IN ISOLATOR.
CM	ADDRESSABLE LOOP POWERED CONTROL/OUTPUT MODULE
MM	ADDRESSABLE LOOP POWERED MONITOR/INPUT MODULE
FACP	INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL WITH BACKUP BATTERIES, BATTERIES CHARGER & NETWORK CARD COMPLETE IN ALL RESPECT
AP	ADRESSABLE FIRE ALARM REPEATER/ANNUNCIATION PANEL INCLUDING ALL MOUNTING AND INSTALLATION ACCESSORIES.

COVERED AREA = 45,798 Sq.Ft.

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

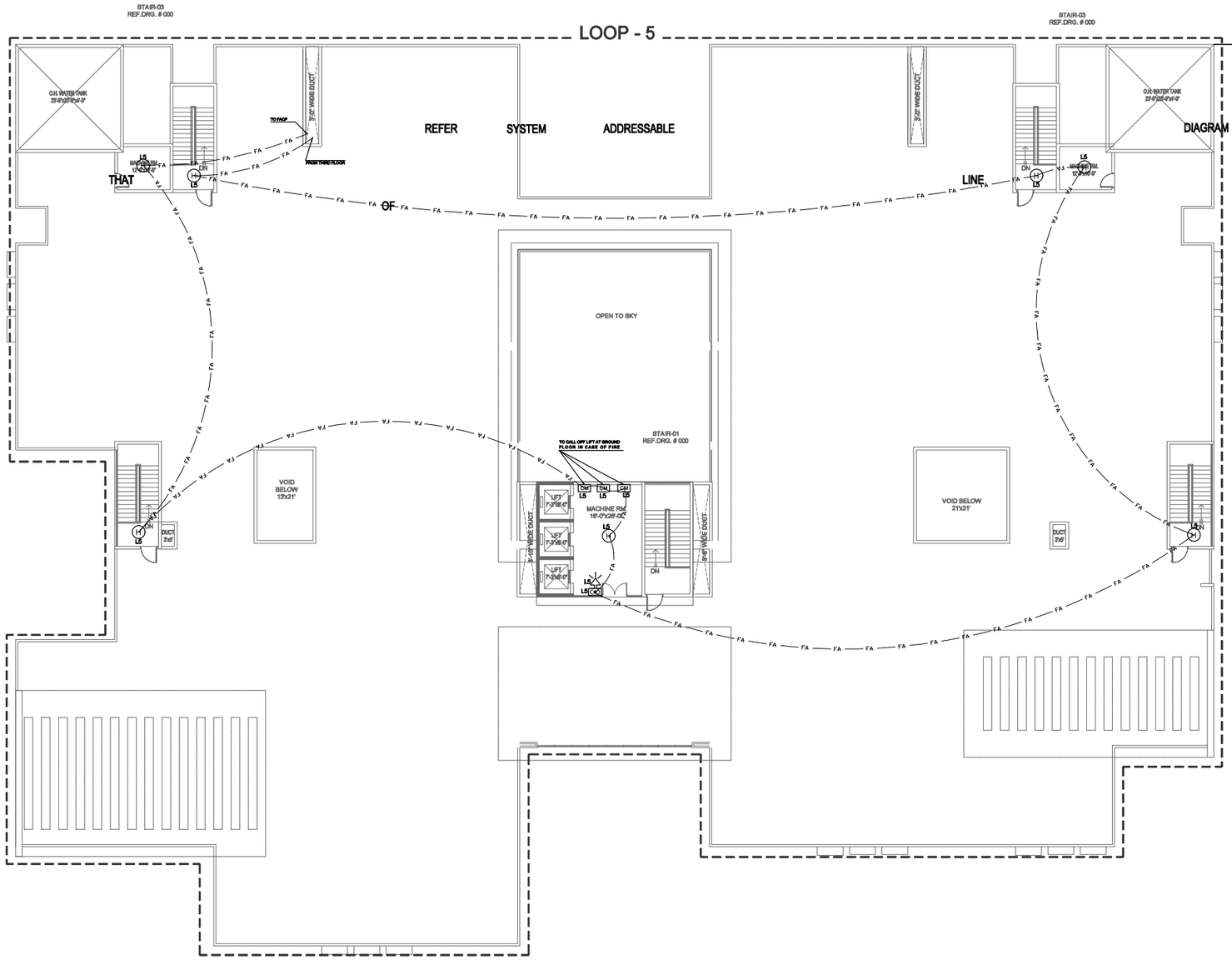
PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
THIRD FLOOR
ADDRESSABLE FIRE ALARM SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED	
DWN. SA				
CKD.	DATE	DRAWING NO.	SCALE	REV.
SUBM.	APRIL, 2025	4268/04/TD/1E105	3/63"=1'-0"	A

SCHEMATIC FIRE ALARM DIAGRAM ADDRESSABLE SYSTEM REFER



THAT OF LINE ANY

NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/TD/E001
3. FOR DRAWING NO. 4268/04/TD/E002

LEGEND:-

SYMBOL	DESCRIPTION
SH	INTELLIGENT ADDRESSABLE LOOP POWERED OPTICAL SMOKE & HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
H	INTELLIGENT ADDRESSABLE LOOP POWERED HEAT DETECTOR WITH BASE & BUILT-IN ISOLATOR.
Tx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (TRANSMITTER)
Rx	ADDRESSABLE LOOP POWERED BEAM DETECTOR (RECEIVER)
	ADDRESSABLE LOOP POWERED MANUAL CALL POINT WITH BASE & BUILT-IN ISOLATOR.
	ADDRESSABLE LOOP POWERED AUDIO VISUAL SOUNDER WITH BASE BUILT-IN ISOLATOR.
CM	ADDRESSABLE LOOP POWERED CONTROL/OUTPUT MODULE
MM	ADDRESSABLE LOOP POWERED MONITOR/INPUT MODULE
FACP	INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL WITH BACKUP BATTERIES, BATTERIES CHARGER & NETWORK CARD COMPLETE IN ALL RESPECT
AP	ADRESSABLE FIRE ALARM REPEATER/ANNUNCIATION PANEL INCLUDING ALL MOUNTING AND INSTALLATION ACCESSORIES.

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

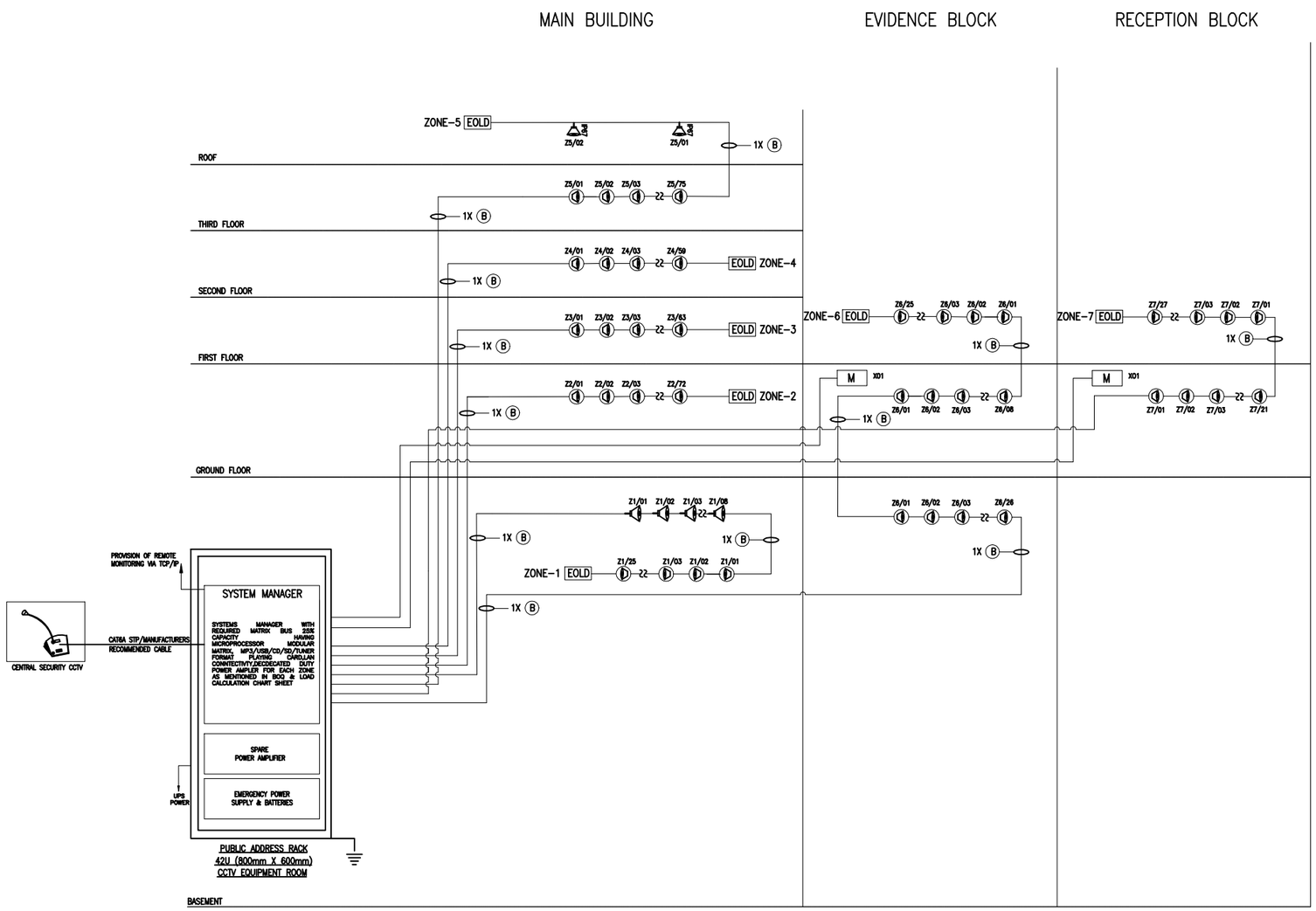
CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

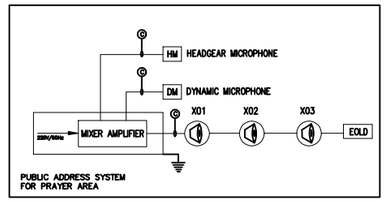
PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
ROOF TOP
ADDRESSABLE FIRE ALARM SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN. SA			
CKD.			
SUBM.			
	DATE: APRIL, 2025	DRAWING NO.: 4268/04/TD/1E106	SCALE: 3/63"=1'-0"
			REV.: A





ZONES	LOAD (WATT)	25% EXPANSION (WATT)
ZONE-1	270	339
ZONE-2	432	540
ZONE-3	378	473
ZONE-4	354	443
ZONE-5	480	600
ZONE-6	156	195
ZONE-7	288	360

LOAD CALCULATION CHART

NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/TD/E001.
3. FOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC REFER DRAWING NO. 4268/04/TD/E002.
4. FOR EXTERNAL CONNECTIVITY OF PUBLIC ADDRESS NETWORK LAYOUT REFER DRAWING NO. 4268/04/TD/4IT114.
5. CONTRACTOR TO CARRYOUT DETAILED ENGINEERING DESIGN FOR PUBLIC ADDRESS SYSTEM IN PRAYER AREA.
6. CONTRACTOR TO PROVIDE DEDICATED AMPLIFIER FOR EACH ZONE AS PER PROPOSED MANUFACTURER.

LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
V	VOLUME CONTROLLER
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
ZX - XX	SPEAKER NUMBER ZONE NUMBER

CLIENT
HOME DEPARTMENT, GOVERNMENT OF SINDH

CONSULTANT
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD.
HEAD OFFICE:- NESPAK HOUSE, I-C, BLOCK-N, MODEL TOWN EXTENSION, LAHORE, PAKISTAN.

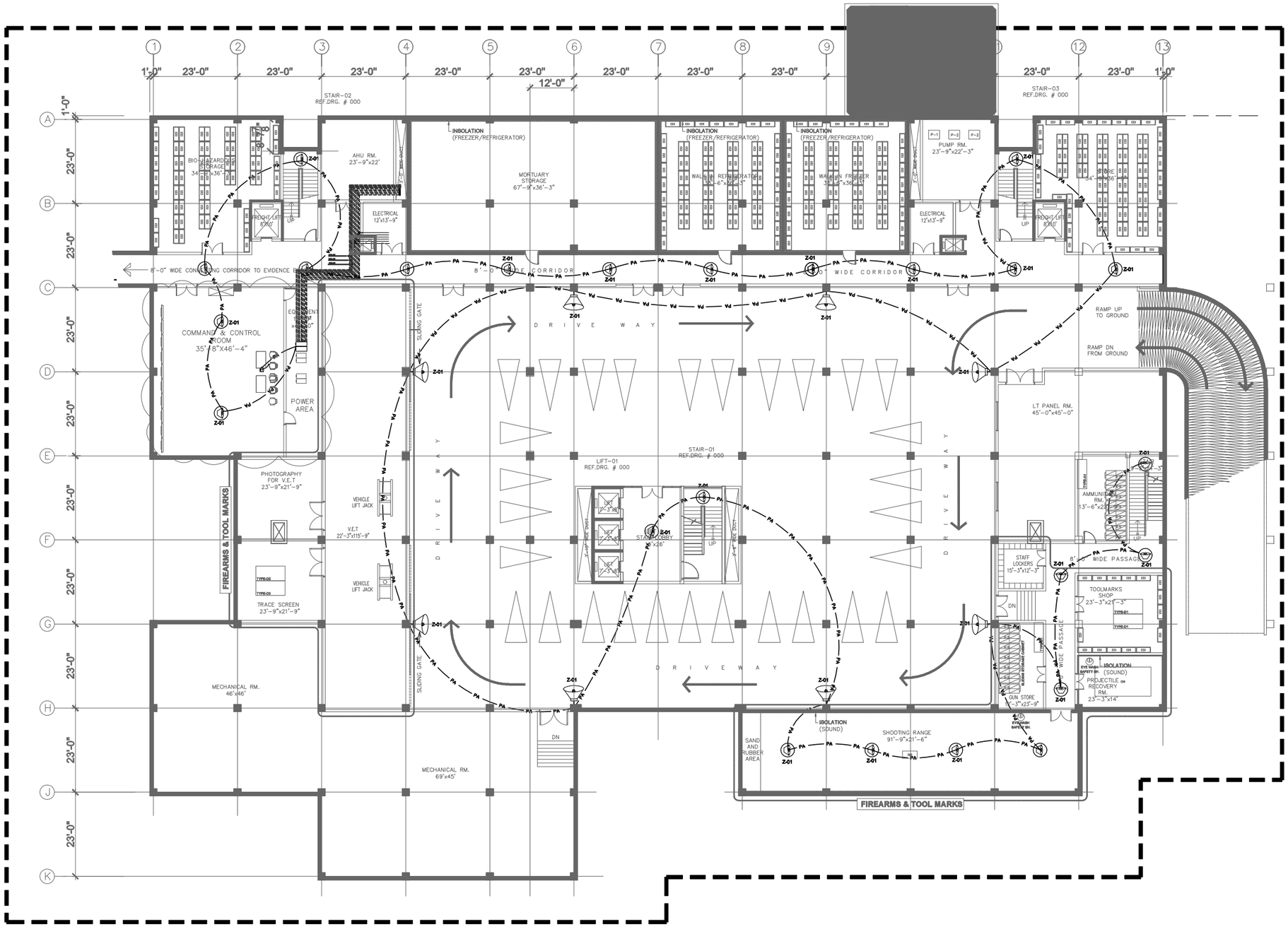
REV.	DATE	DESCRIPTION	APPROVED
04			
03			
02			
01			

DRAWN	SA
SUBMITTED	
RECOMMENDED	
CHD./VER.	
APPROVED	

PROJECT
ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SCHEMATIC DIAGRAM OF PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT PLAN

DATE: APRIL, 2025
DRAWING No.: 4268/04/TD/E003
SCALE:
REV.: 0



ZONE-01



NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/TD/E001
3. FOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC REFER DRAWING NO. 4268/04/TD/E003

LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
ZX - XX	SPEAKER NUMBER ZONE NUMBER

COVERED AREA = 45,798 Sq.Ft.

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

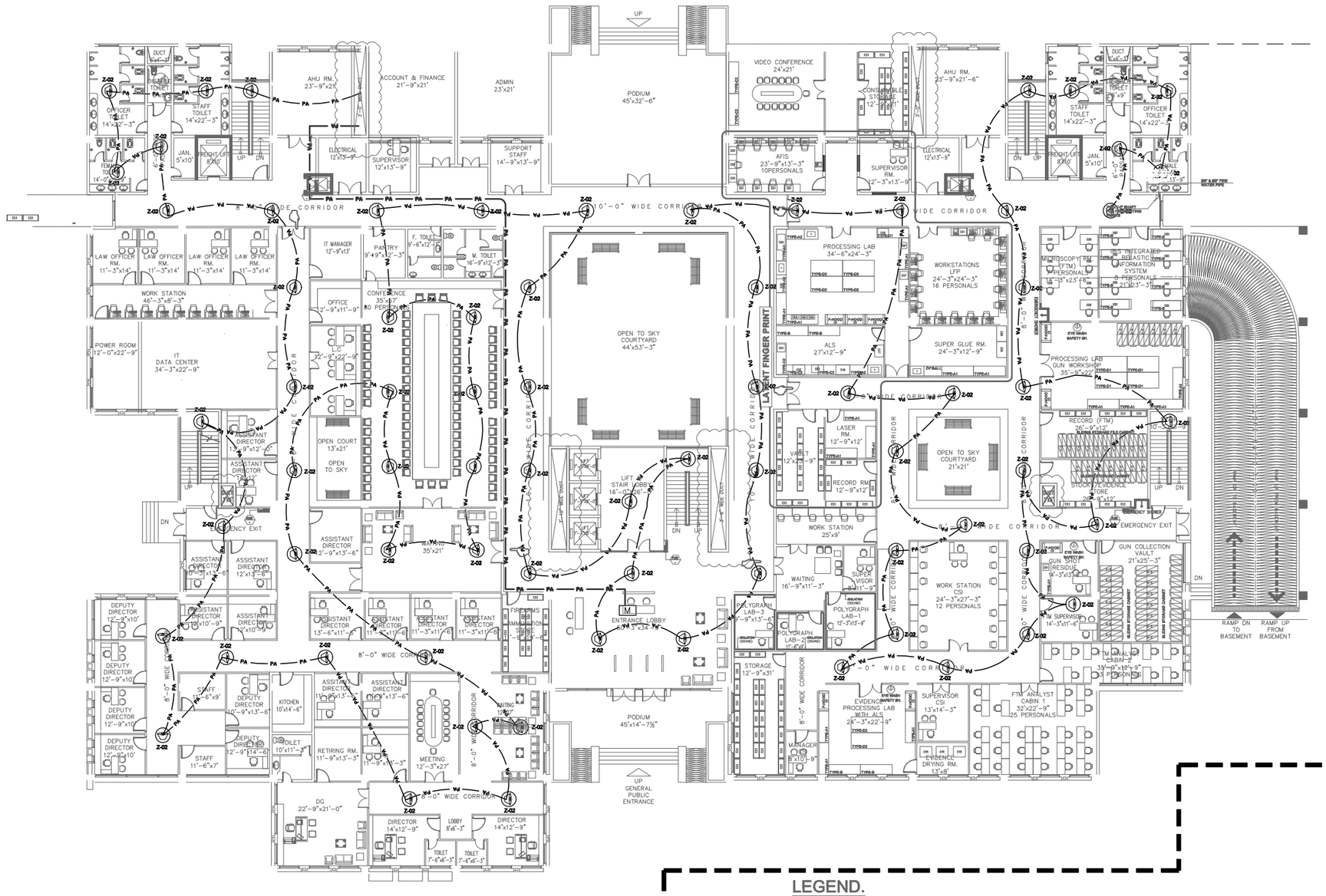
CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
BASEMENT FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED	
DWN. SA				
CKD.	DATE	DRAWING NO.	SCALE	REV.
SUBM.	APRIL, 2025	4268/04/TD/1E107	3/63"=1'-0"	A



LEGEND.

ZONE-02



NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/TD/E001
3. FOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC REFER DRAWING NO. 4268/04/TD/E002

LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
ZX - XX	SPEAKER NUMBER ZONE NUMBER

COVERED AREA = 45,798 Sq.Ft.

REFERENCE DRAWINGS	REV. NO	DATE	DESCRIPTION	BY	CKD.	APPR.

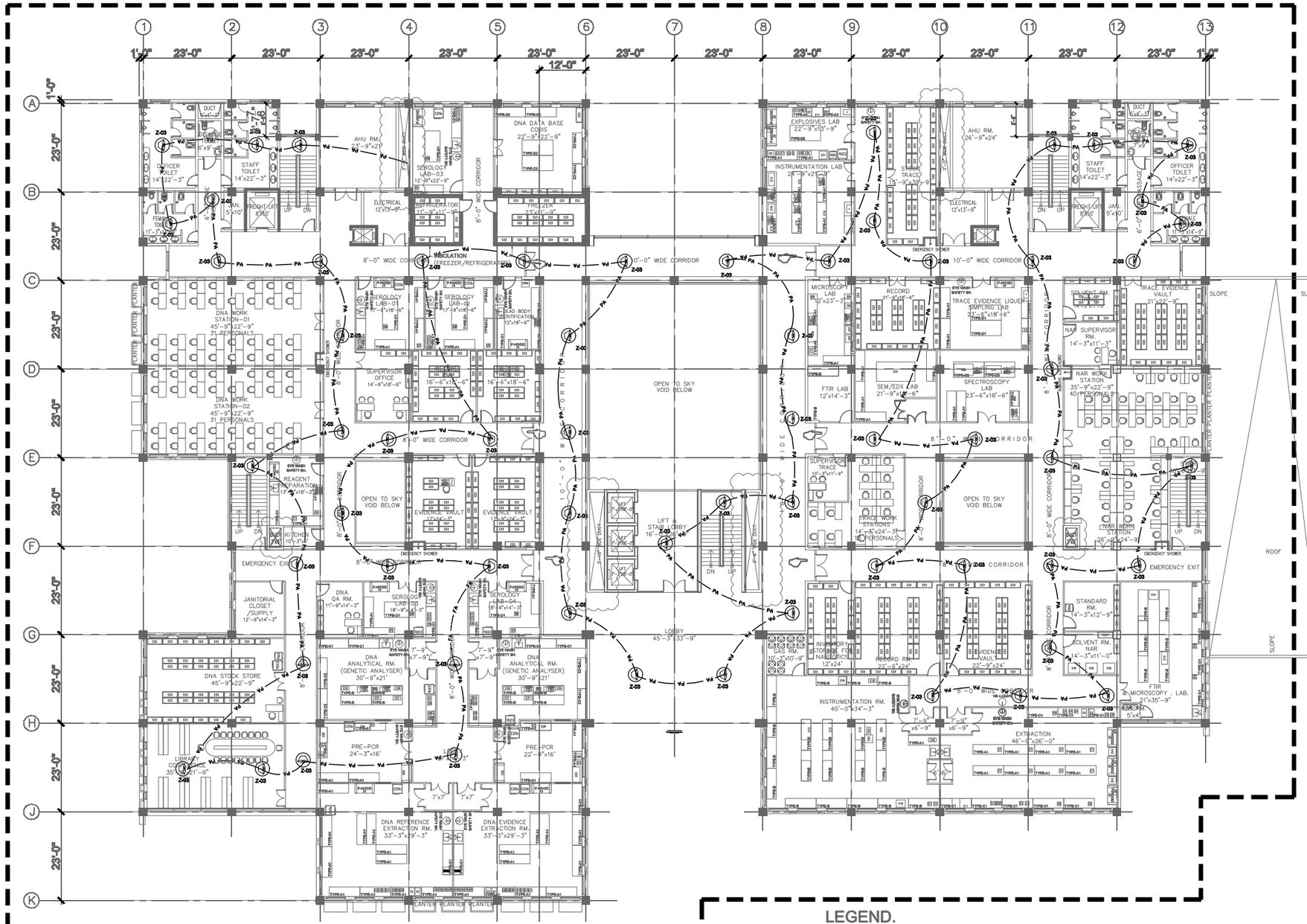
CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
BASEMENT FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED	
DWN. SA				
CKD.	DATE	DRAWING NO.	SCALE	REV.
SUBM.	APRIL, 2025	4268/04/TD/1E105	3/63"=1'-0"	A



ZONE-03

LEGEND.

W
S
N
E

NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/TD/E001
3. FOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC REFER DRAWING NO. 4268/04/TD/E002

LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
ZX - XX	SPEAKER NUMBER ZONE NUMBER

COVERED AREA = 45,798 Sq.Ft.

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

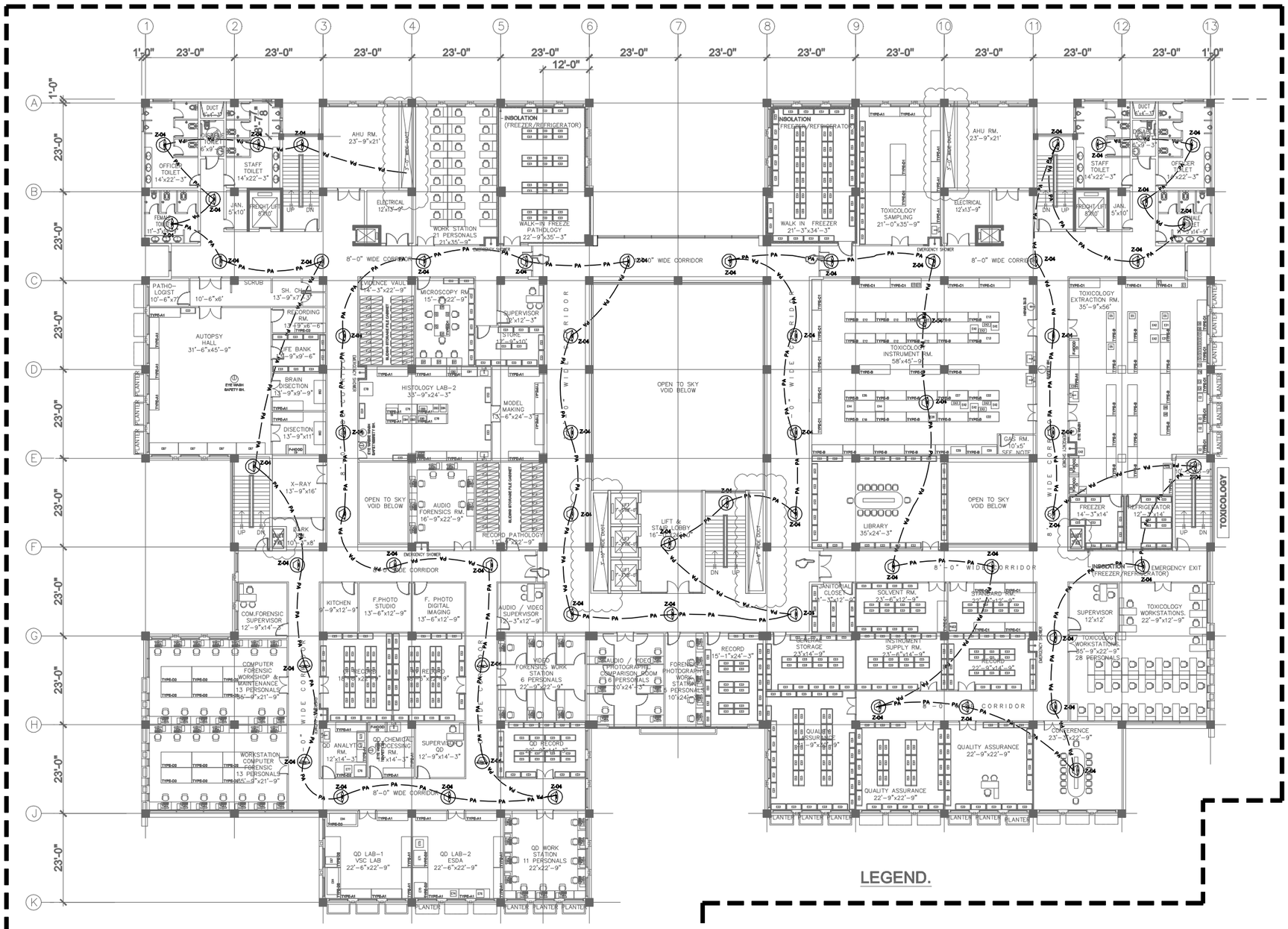
CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
BASEMENT FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED	
DWN. SA				
CKD.	DATE	DRAWING NO.	SCALE	REV.
SUBM.	APRIL, 2025	4268/04/TD/1E105	3/63"=1'-0"	A



ZONE-04

W
S
N
E

NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/TD/E001
3. FOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC REFER DRAWING NO. 4268/04/TD/E002

LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
ZX - XX	SPEAKER NUMBER ZONE NUMBER

COVERED AREA = 45,798 Sq.Ft.

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

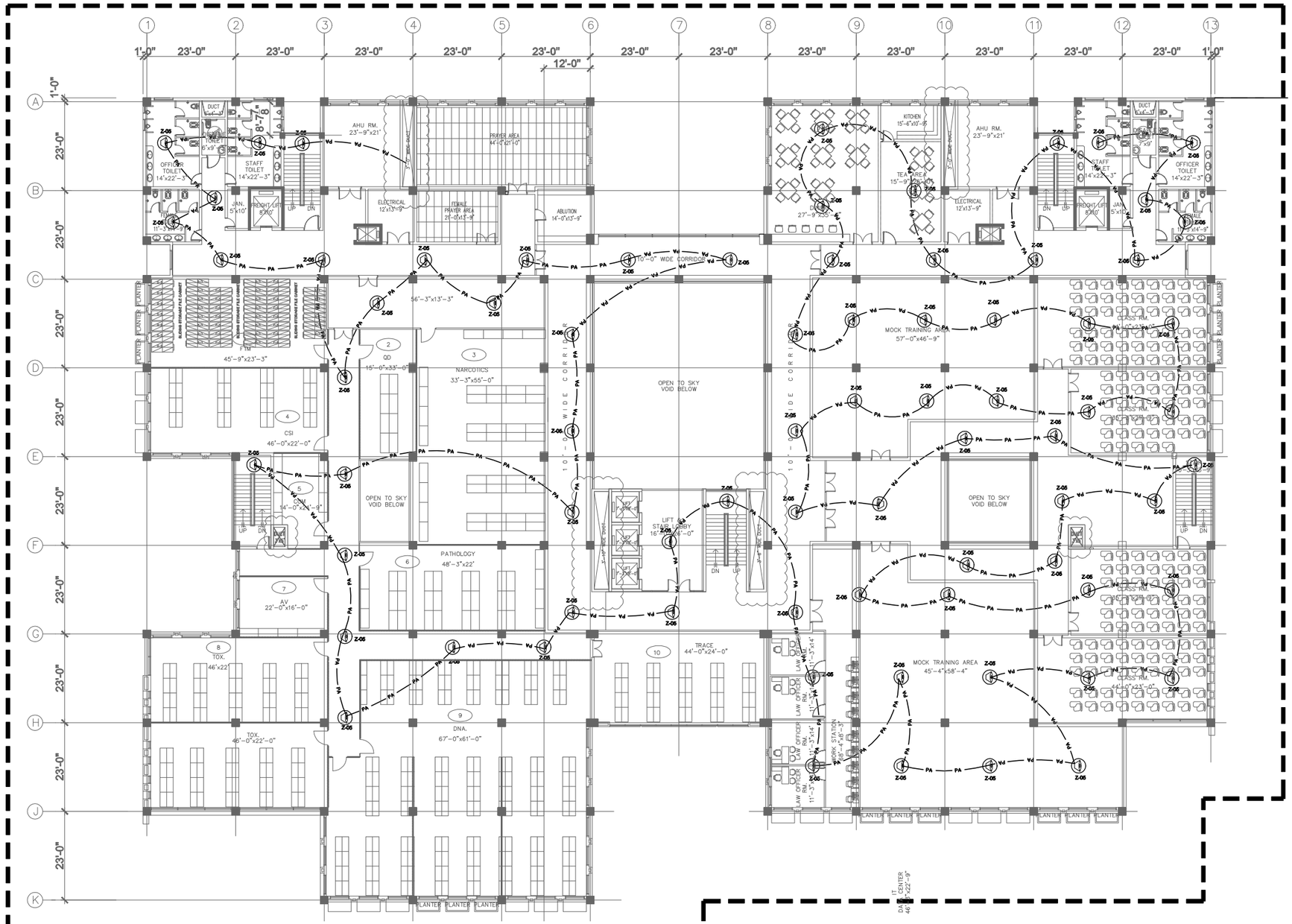
CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
BASEMENT FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN. SA			
CKD.	DATE	DRAWING NO.	SCALE / REV.
SUBM.	APRIL, 2025	4268/04/TD/1E105	3/63"=1'-0" / A



ZONE-05 TRAINING & MAIN STORAGE FLOOR



NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/TD/E001
3. FOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC REFER DRAWING NO. 4268/04/TD/E002

LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
ZX - XX	SPEAKER NUMBER ZONE NUMBER

COVERED AREA = 45,798 Sq.Ft.

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

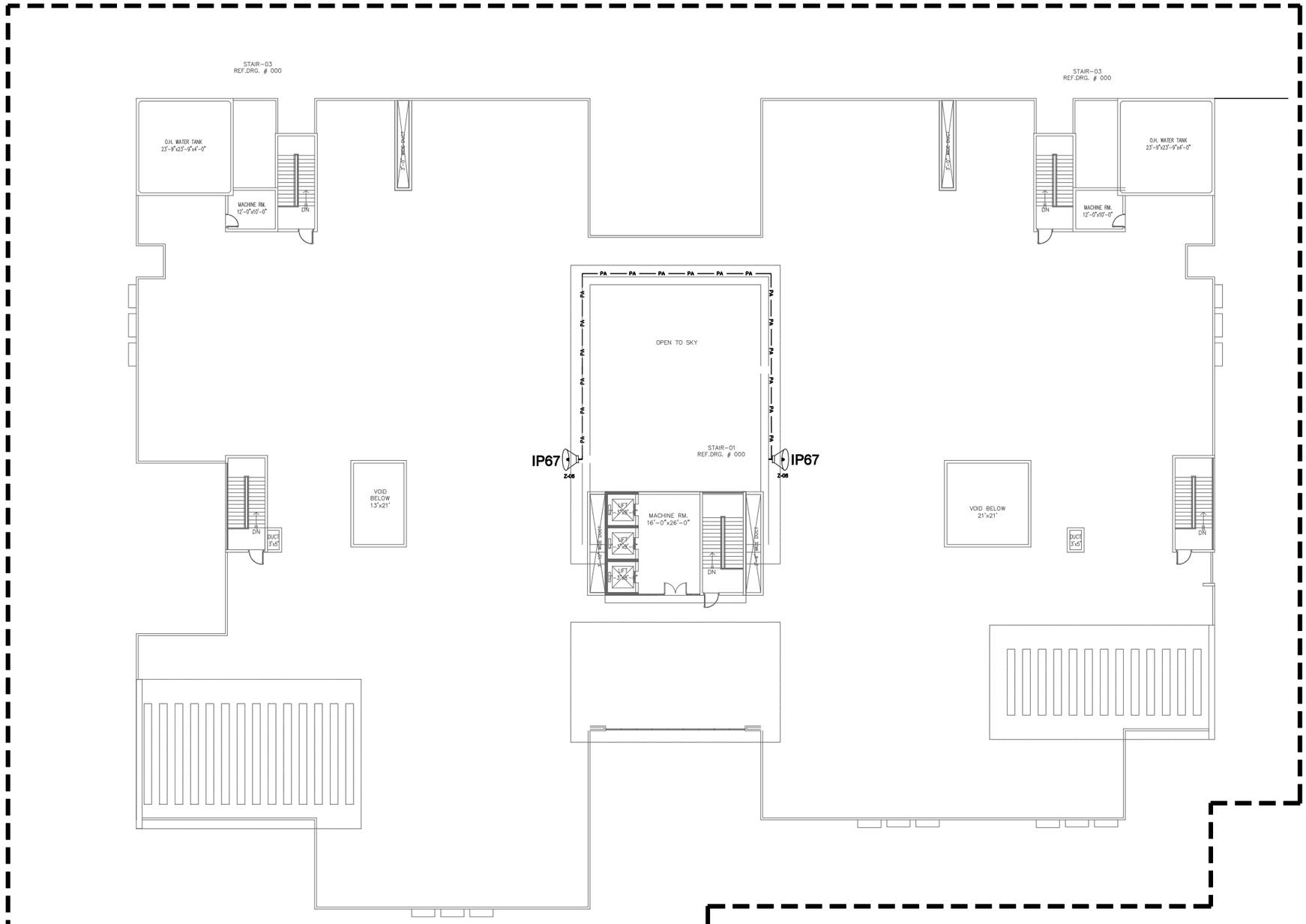
CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

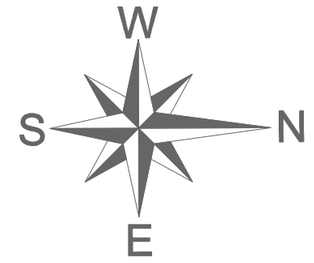
SHEET TITLE: MAIN BUILDING BASEMENT FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED	
DWN. SA				
CKD.	DATE	DRAWING NO.	SCALE	REV.
SUBM.	APRIL, 2025	4268/04/TD/1E105	3/63"=1'-0"	A



ZONE-05



NOTES:-

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED.
2. FOR GENERAL NOTES REFER DRAWING NO. 4268/04/TD/E001
3. FOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM SCHEMATIC REFER DRAWING NO. 4268/04/TD/E002

LEGEND:-

SYMBOL	DESCRIPTION
	HORN SPEAKER
IP67	WEATHER PROOF HORN SPEAKER (IP67 RATED)
	CEILING SPEAKER.
EOLD	END OF LINE DEVICE.
M	MICROPHONE SOCKET OUTLET FOR PAGING MICROPHONE
	REMOTE MICROPHONE
	PUBLIC ADDRESS RACK
ZX - XX	SPEAKER NUMBER ZONE NUMBER

COVERED AREA = 45,798 Sq.Ft.

CLIENT: HOME DEPARTMENT, GOVERNMENT OF SINDH

PROJECT: ESTABLISHMENT OF SINDH FORENSIC SCIENCE LABORATORY KARACHI

SHEET TITLE: MAIN BUILDING
BASEMENT FLOOR PUBLIC ADDRESS & VOICE EVACUATION SYSTEM LAYOUT PLAN

CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED, KARACHI

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD.	APPR.

DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED	
DWN. SA				
CKD.	DATE	DRAWING NO.	SCALE	REV.
SUBM.	APRIL, 2025	4268/04/TD/1E105	3/63"=1'-0"	A