



**Sindh Madressatul Islam  
University**

**DEVELOPMENT OF SINDH MADRESSATUL ISLAM UNIVERSITY  
(SMIU) CAMPUS AT EDUCATION CITY MALIR, KARACHI  
(LOT NO.1, FACULTY BLOCKS-2 NOS.)**



**Tender Document  
Volume-I  
Conditions of Contract**



**EA Consulting Pvt Ltd**

ARCHITECTURE | ENGINEERING | PROJECT MANAGEMENT  
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**INVITATION  
FOR  
BIDS**



# SINDH MADRESSATUL ISLAM UNIVERSITY

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NO. SMIU/W&S/TEND-2018/38

Date: 31<sup>st</sup> December, 2018

## RE-TENDER NOTICE

Sealed bids are invited on standard bidding documents (SBDs) from interested contractors/firms for the following work. The tender shall be based on the single stage – one envelope procedure under Rule No 46 (1) of SPPRA-Rules 2010 (Amended-2017).

S.No	Name of Work	Bid Security	Estimate Cost (Rs. In Millions)	Tender Fee	Time for Completion
1.	DEVELOPMENT OF SINDH MADRESSATUL ISLAM UNIVERSITY (SMIU) CAMPUS AT EDUCATION CITY MALIR, KARACHI (LOT #1, FACULTY BLOCKS 2 NOS.)	2% of Bid Price	450 (M)	Rs. 5,000/-	18 Months

### Terms & Conditions:

- 1- Tender documents can be obtained against the written request on company letter head along with Proprietor's CNIC copy or authorized nominee from the office of **Directorate of Works and Services** Sindh Madressatul Islam University, Karachi with a Pay Order / Demand Draft as Tender Fee mentioned above (non-refundable) in favour of Sindh Madressatul Islam University on any working day during office hours from **Thursday 3<sup>rd</sup> January 2019** to **Thursday 17<sup>th</sup> January 2019** and can be downloaded from SPPRA website: [www.pprasindh.gov.pk](http://www.pprasindh.gov.pk) and SMI University website: [www.smiu.edu.pk](http://www.smiu.edu.pk)
- 2- The filled Sealed Tenders will be received back on **Friday 18<sup>th</sup> January 2019 by 15:00 hours** and will be opened on same day at **15:30 hours** in the **Conference Room No. 02, first floor Main building at Sindh Madressatul Islam University, Aiwan-e- Tijarat Road Behind Habib Bank Plaza, Karachi** before the procurement committee and the bidders or their authorized representatives who wish to be present.

### 3- **Eligibility Criteria:**

- a. Valid registration with Pakistan Engineering Council (PEC) category C-3 or above in the relevant field of specialization of work in CE09, CE10, EE04.
- b. Similar nature work orders and completion certificate by client of greater than 500 million (cumulative)
- c. Registration with income tax department (NTN certificates) with activated status in Federal Board of Revenue along with three months return.
- d. Registration certificate of Sindh Revenue Board Government of Sindh STN Certificate.
- e. Bio Data of Engineering and Technical Staff working with the firm along with attested CVs.
- f. Documentary evidence of work executed / works in progress and certificate of satisfactory completion of works by the employers during at least last three years. List of works should indicate cost of each work and copy of letter of award of work.
- g. List of machinery and equipment available.
- h. An affidavit certificate that the firm has never been black listed by Government/ Semi Government / Autonomous / Private bodies and that the firm has not been involved in any litigation and arbitration with Government/ Semi Government / Autonomous / Private bodies.
- i. In case of partners / partnership deed, giving full particulars, Directors/Proprietors or other connected along with the Power of Attorney. In case of being sole proprietors such undertaking on affidavit be furnished.
- j. Audited financial statements for last three (3) years.
- k. The interested bidders must have turnover of at least 500 Million for last 3 years.
- l. In case of joint ventures, same conditions to be fulfilled by both the firms.

- m. Affidavit with effect that all the documents/ particulars information furnished are true correct.
  - n. All documents from Sr.No. “a” to “m” mentioned in the eligibility Criteria of this NIT will be examined at the time of opening of tender. However, the tender documents will be issued to all interested bidders.
- 4- Bid Validity Period is 90 days
  - 5- The earnest money at the rate of 2% of bid price should be submitted along with Bid in shape of Call Deposit/Pay order/Demand Draft issued by any scheduled bank of Pakistan in favor of Sindh Madressatul Islam University Karachi.
  - 6- Conditional bid and bid **without earnest money** shall not be considered.
  - 7- Bids must be offered on the prescribed bidding documents issued by Sindh Madressatul Islam University or downloaded from SPPRA/SMIU website.
  - 8- In case of downloading the tender documents from SPPRA or SMIU website, the tender fee is required to be submitted along with the bid.
  - 9- Procuring Agency reserves the right to reject all or any bids subject to the relevant provisions of SPPRA Rules-2010 amended (2017).
  - 10- In case any unforeseen situation resulting in closure of office on the date of opening or if Government declares Holiday, the tender shall be submitted/opened on the next working day at the same time and venue.

**Project Coordinator  
(SMIU Malir Campus)**

# **INSTRUCTIONS TO BIDDERS**

## INSTRUCTIONS TO BIDDERS

(Note: These Instructions to Bidders along with Bidding Data will not be part of the Contract and will cease to have effect once the contract is signed.)

### A. GENERAL

#### IB.1 Scope of Bid

- 1.1 The Procuring Agency as defined in the Bidding Data hereinafter called "the Procuring Agency" wishes to receive bids for the construction and completion of works as described in these Bidding Documents, and summarised 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 para-6 of Appendix-A to Bid.

#### IB.2 Source of Funds

- 2.1 The Procuring Agency has applied for/received credit from the source (s) indicated in the Bidding Data in various instalments towards the cost of the project specified in the Bidding Data and intended that part of the proceeds of this loan/credit will be applied towards payments under the Contract for which these Bidding Documents are issued.

#### IB.3 Eligible Bidders

- 3.1 This Invitation for Bids is open for all interested Contractors fulfilling following eligibility criteria mentioned in NIT as follows:-
  - a. Valid registration with Pakistan Engineering Council (PEC) category C-3 or above in the relevant field of specialization of work in CE09, CE10, EE04.
  - b. Similar nature work orders and completion certificate by client of greater than 500 million (cumulative)
  - c. Registration with income tax department (NTN certificates) with activated status in Federal Board of Revenue along with three months return.
  - d. Registration certificate of Sindh Revenue Board Government of Sindh STN Certificate.
  - e. Bio Data of Engineering and Technical Staff working with the firm along with attested CVs.
  - f. Documentary evidence of work executed / works in progress and certificate of satisfactory completion of works by the employers during at least last three years. List of works should indicate cost of each work and copy of letter of award of work.
  - g. List of machinery and equipment available.



- h. An affidavit certificate that the firm has never been black listed by Government/ Semi Government / Autonomous / Private bodies and that the firm has not been involved in any litigation and arbitration with Government/ Semi Government / Autonomous / Private bodies.
- i. In case of partners / partnership deed, giving full particulars, Directors/Proprietors or other connected along with the Power of Attorney. In case of being sole proprietors such undertaking on affidavit be furnished.
- j. Audited financial statements for last three (3) years.
- k. The interested bidders must have turnover of at least 500 Million for last 3 years.
- l. In case of joint ventures, same conditions to be fulfilled by both the firms.
- m. Affidavit with effect that all the documents/ particulars information furnished are true correct.

#### **IB.4 One Bid per Bidder**

- 4.1 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.16) will be disqualified.

#### **IB.5 Cost of Bidding**

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

#### **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 Procuring Agency 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 Procuring Agency, 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. General Conditions of Contract, Part-I (GCC).
4. Particular Conditions of Contract, Part-II (PCC).
5. Specifications – Special Provisions.
6. Specifications - Technical Provisions.
7. Form of Bid & Appendices to Bid.
8. Bill of Quantities (Appendix-D to Bid).
9. 2% Bid Security in shape of call deposit/pay order/demand draft issued by any scheduled bank of Pakistan in favor of **“Sindh Madressatul Islam University, Karachi”**
10. Form of Contract Agreement.
11. Forms of Performance Security and Mobilization Advance Bank Guarantee.
12. 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**

8.1 Any bidder requiring any clarification (s) in respect of the Bidding Documents may notify the Procuring Agency in writing at the Procuring Agency's address indicated in the Invitation for Bids/NIT. The Procuring Agency will respond to any request for clarification provided they are received at least five calendar days prior to the date of opening of bid.

Provided that any clarification in response to query by any bidder; shall be communicated to all parties who have obtained bidding documents.

### **IB.9 Amendment of Bidding Documents**

9.1 At any time prior to the deadline for submission of bids, the Procuring Agency 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 pursuant to Sub-Clause 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 Procuring Agency.

9.3 To afford prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Procuring Agency may extend the deadline for submission of bids in accordance with Clause IB.20

## C. PREPARATION OF BIDS

### IB.10 Language of Bid

10.1 The bid and all correspondence and documents related to the bid exchanged by a bidder and the Procuring Agency 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 an accurate 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.11 Documents Accompanying the Bid

11.1 Each bidder shall:

- (a) submit a written power of attorney authorizing the signatory of the bid to act for and on behalf of the bidder;
- (b) update the information indicated and listed in the Bidding Data and previously submitted with the application for prequalification, and certify to meet the minimum criteria set out in the prequalification forms which as a minimum, would include the following :
  - (i) Evidence of access to financial resources along with average annual construction turnover;
  - (ii) Financial prediction for the current year and the two following years including the effect of known commitments;
  - (iii) Work commitments since prequalification;
  - (iv) Court blacklisting & litigation information by providing an affidavit non-judicial stamp paper that the firm has never been black listed by Government/ Semi Government / Autonomous / Private bodies and that the firm has not been involved in any litigation and arbitration with Government/ Semi Government / Autonomous / Private bodies; and
  - (v) Availability of critical equipment.

and

- (c) furnish a technical proposal taking into account the various Appendices to Bid specially the following:

Appendix-E to Bid	Proposed Construction Schedule
Appendix-F to Bid	Method of Performing the Work
Appendix-G to Bid	List of Major Equipment
Appendix-K to Bid	Organization Chart for Supervisory Staff

and other pertinent information such as mobilization programme etc;

11.2 Bids submitted by a joint venture of two (2) or more firms shall comply with the following requirements:-

- (a) the bid and in case of a successful bid, the Form of Contract Agreement shall be signed 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 Procuring Agency 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 Form of Bid and in the Form of Contract Agreement (in case of a successful bid)
- (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 and obligate 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 of the several firms forming the joint venture, and any other information necessary to permit a full appraisal of its functioning. No amendments / modifications whatsoever in the joint venture agreement shall be agreed to between the joint venture partner without prior written consent of the Procuring Agency.

11.3 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 1.2 hereof.

## **IB.12 Bid Prices**

12.1 Unless stated otherwise in the Bidding Documents, the Contract shall be for the whole of the Works as described in Sub-Clause 1.1 hereof, based on the unit rates and / or prices submitted by the bidder or percentage quoted above or below on the rates of PWD- Schedule 2012 (Government of Pakistan), as the case may be.

12.2 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 Procuring Agency when executed and shall be deemed covered by rates and prices for other items in the Bill of Quantities. In case of PWD- Schedule 2012 (Government of Pakistan) if the bidder fails to mention the percentage above or below, it shall be deemed to be at par with the rates of PWD-Schedule 2012 (Government of Pakistan)

12.3 The Bid price submitted by the contractor shall include all rates and prices including the taxes. All Duties, taxes and other levies payable by the contractor under the contract.

Additional / reduced duties, taxes and levies due to subsequent additions or changes in legislation shall be reimbursed / deducted as per Sub-Clause 70.2 of the General Conditions of Contract Part-I.

12.4 The rates and prices quoted by the bidders are subject to adjustment during the performance of the Contract in accordance with the provisions of Clause 70 of the Conditions of Contract. The bidders shall furnish the prescribed information for the price adjustment formulae in Appendix-C to Bid, and shall submit with their bids such other supporting information as required under the said Clause.

### **IB.13 Currencies of Bid and Payment**

- 13.1 The unit rates and the prices shall be quoted by the bidder entirely in Pak rupees. A bidder expecting to incur expenditures in other currencies for inputs to the Works supplied from outside the Procuring Agency's country (referred to as the "Foreign Currency Requirements") shall indicate the same in Appendix-B to Bid. The proportion of the Bid Price (excluding Provisional Sums) needed by him for the payment of such Foreign Currency Requirements either (i) entirely in the currency of the Bidder's home country or, (ii) at the bidder's option, entirely in Pak rupees provided always that a bidder expecting to incur expenditures in a currency or currencies other than those stated in (i) and (ii) above for a portion of the foreign currency requirements, and wishing to be paid accordingly, shall indicate the respective portions in his bid.
- 13.2 The rates of exchange to be used by the bidder for currency conversion shall be the TT&OD Selling Rates published or authorized by the State Bank of Pakistan prevailing on the date 28 days prior to the deadline for the submission of bids.

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

### **IB.14 Bid Validity**

- 14.1 Bids shall remain valid for the period stipulated in the Bidding Data after the Date of Bid Opening specified in Clause IB.23.
- 14.2 In exceptional circumstances, prior to expiry of the original bid validity period, the Procuring Agency may request that the bidders extend the period of validity for a specified additional period which shall in no case 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 be required to extend the validity of his Bid Security for the period of the extension, and in compliance with Clause IB.15 in all respects.

### **IB.15 Bid Security**

- 15.1 Each bidder shall furnish, as part of his bid, a Bid Security in the shape of call deposit/pay order/demand draft and in the form as stipulated in the Bidding Data ( sub-para 15.1) in Pak Rupees .
- 15.2 The Bid Security shall be, at the option of the bidder, in shape of call deposit/pay order/demand draft issued by a Scheduled Bank in Pakistan in favour of the Procuring Agency valid for a period 28 days beyond the Bid Validity date.
- 15.3 Any bid not accompanied by an acceptable Bid Security shall be rejected by the Procuring Agency as non-responsive.
- 15.4 The bid securities shall be released to the unsuccessful bidders once the contract has been signed with the successful bidder or validity period has expired.
- 15.5 The Bid Security of the successful bidder will be returned when the bidder has furnished the required Performance Security and signed the Contract Agreement.
- 15.6 The Bid Security may be forfeited:
- (a) if the bidder withdraws his bid except as provided in Sub-Clause 22.1;

- (b) if the bidder does not accept the correction of his Bid Price pursuant to Sub-Clause 27.2 hereof; or
- (c) In the case of successful bidder, if he fails within the specified time limit to sign the Contract Agreement.

#### **IB.16 Alternate Proposals by Bidder**

- 16.1 Each Bidder shall submit only one bid either by himself, or as a member of joint venture.
- 16.2 Alternate Proposal(s), if any, of the lowest evaluated responsive bidder only may be considered by the Procuring Agency for the award of Contract to such bidder.

#### **IB.17 Pre-Bid Meeting**

- 17.1 The Procuring Agency may, on his own motion or at the request of any 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, shall be communicated to all concerned bidders or their authorized representatives shall be invited to attend such a pre-bid meeting at their own expenses.
- 17.2 The Concerned bidders are requested to submit questions, if any, in writing so as to reach the Procuring Agency not later than 7 days before the proposed pre-bid meeting as mentioned in sub-para 17.1 Bidding Data.
- 17.3 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 to the Bidding Documents listed in Sub-Clause 7.1 hereof which may become necessary as a result of the pre-bid meeting shall be made by the Procuring Agency exclusively through the issue of an Addendum pursuant to Clause IB.9 and not through the minutes of the pre-bid meeting.
- 17.4 Absence at the pre-bid meeting will not be a cause for disqualification of a bidder.

#### **IB.18 Format and Signing of Bid**

- 18.1 Bidders are particularly directed that the amount entered on the Form of Bid shall be for performing the Contract strictly in accordance with the Bidding Documents.
- 18.2 All appendices to Bid are to be properly completed and signed.
- 18.3 No alteration is to be made in the Form of Bid nor in the Appendices 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 out the forms completely and without alterations one (1) original and one (1) copy of Bidding Documents with one additional copy of Volume-III, specified in the Bidding Data, of the documents comprising the bid as described in Clause IB.7 and clearly mark them "ORIGINAL" and "COPY" as appropriate. In the event of discrepancy between them, the original shall prevail.

- 18.5 The original and copies of the bid shall be typed or written in indelible ink (in the case of copies, Photostats are also acceptable) and shall be signed by a person or persons duly authorized to sign on behalf of the bidder pursuant to Sub- Clause 11.1 (a) 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 Procuring Agency, or as are necessary to correct errors made by the bidder, in which case such corrections shall be initialled by the person or persons signing the bid.
- 18.7 Bidders shall indicate in the space provided in the Form 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 as their file copy.

## **D. SUBMISSION OF BIDS**

### **IB.19 Sealing and Marking of Bids**

- 19.1 Each bidder shall submit his bid as under:-
- (a) Three (3) copies of Volume-III; the said copies are to be marked as ORIGINAL, 1<sup>st</sup> Copy and 2<sup>nd</sup> Copy; One (1) copy of all the other Bid Documents. Successful Bidder shall submit three (3) additional copies of the Bid/Contract Documents, if and when so required.
  - (b) ORIGINAL and each copy of the Bid shall be put in individual envelopes and marked as such (i.e. Original, 1<sup>st</sup> Copy and 2<sup>nd</sup> Copy) and each of these envelopes must be properly sealed.
  - (c) The above three envelopes containing the ORIGINAL and copies will be put in one sealed envelope and addressed / identified as given in Sub- Clause 19.2 hereof.
- 19.2 The inner and outer envelopes shall:-
- (a) be addressed to the Procuring Agency at the address provided in subpara-1.1 of the Bidding Data;
  - (b) bear the name and identification number of the contract as defined as mentioned in sub-para-1.2 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 19.2 hereof, the inner envelope shall indicate the name and address of the bidder to enable the bid to be returned unopened in case it is declared "late" pursuant to Clause IB.21
- 19.4 If the outer envelope is not sealed and marked as above, the Procuring Agency 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 Procuring Agency 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, a bidder wishes to receive an acknowledgment of receipt of his bid, he shall make a request for such acknowledgment in a separate letter attached to but not included in the sealed bid pack.
- (d) Upon request, acknowledgment of receipt of bids will be provided to those making delivery in person or by messenger.
- 20.2 The Procuring Agency 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 of the Procuring Agency 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 Procuring Agency after the deadline for submission of bids prescribed in Clause IB.20 will be 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 submit the bid in time.

## **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 Procuring Agency prior 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 22.1 and 27.2.
- 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 Form of Bid may result in forfeiture of the Bid Security in pursuance to Clause IB.15.



## **E. BID OPENING AND EVALUATION**

### **IB.23 Bid Opening**

- 23.1 The Procuring Agency 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.
- 23.3 The bidder's name, total Bid Price and price of any Alternate Proposal(s), any discounts, bid modifications, substitution and withdrawals, the presence or absence of Bid Security, and such other details as the Procuring Agency may consider appropriate, will be announced by the Procuring Agency aloud at the opening of bids.
- 23.4 Procuring Agency shall prepare minutes of the bid opening, including the information disclosed to those present in accordance with the Sub-Clause 23.3.

### **IB.24 Process to be Confidential**

- 24.1 Information relating to the examination, clarification, evaluation and comparison of bid and recommendations for the award of a contract shall not be disclosed to bidders or any other person not officially concerned with such process before the announcement of bid evaluation report in accordance with the requirements of Rule 45, which states that Procuring Agency shall announce the results of bid evaluation in form of report giving reasons for acceptance or rejection of bids. The report shall be hoisted on website of authority and that of procuring agency if its website exists and intimated to all bidders at least 7 (seven) days prior to the 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 Procuring Agency's processing of bids or award decisions may result in the rejection of such bidder's bid. Whereas any bidder feeling aggrieved may lodge a written complaint as per Rule 31; however mere fact of lodging a complaint shall not warrant suspension of the procurement process.

### **IB.25 Clarification of Bids**

- 25.1 To assist in the examination, evaluation and comparison of bids, the Procuring Agency may, at his discretion, ask any bidder for clarification of his bid, including breakdowns of unit rates. The request for clarification and the response shall be in writing but 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 Procuring Agency in the evaluation of the bids in accordance with Clause IB.28.

### **IB.26 Examination of Bids and Determination of Responsiveness**

- 26.1 Prior to the detailed evaluation of bids, the Procuring Agency will determine whether each bid is substantially responsive to the requirements of the Bidding Documents.

- 26.2 A substantially responsive bid is one which (i) meets the eligibility criteria; (ii) has been properly signed; (iii) is accompanied by the required Bid Security; and (iv) conforms to all the terms, conditions and specifications of the Bidding Documents, without material deviation or reservation. A material deviation or reservation is one (i) which affect in any substantial way the scope, quality or performance of the Works; (ii) which limits in any substantial way, inconsistent with the Bidding Documents, the Procuring Agency's rights or the bidder's obligations under the Contract; or (iii) adoption/rectification whereof would affect unfairly the competitive position of other bidders presenting substantially responsive bids.
- 26.3 If a bid is not substantially responsive, it will be rejected by the Procuring Agency and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation or reservation.

#### **IB.27 Correction of Errors**

- 27.1 Bids determined to be substantially responsive will be checked by the Procuring Agency for any arithmetic errors. Errors will be corrected by the Procuring Agency as follows:
- (a) where there is a discrepancy between the amounts in figures and in words, the amount in words will govern; and
  - (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 Procuring Agency there is an obviously gross misplacement of the decimal point in the unit rate, in which case the line item total as quoted will govern and the unit rate will be corrected.
- 27.2 The amount stated in the Form of Bid will be adjusted by the Procuring Agency 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 15.6(b) hereof.

#### **IB.28 Evaluation and Comparison of Bids**

- 28.1 The Procuring Agency will evaluate and compare only the Bids determined to be substantially responsive in accordance with Clause IB.26.
- 28.2 In evaluating the Bids, the Procuring Agency will determine for each Bid the evaluated Bid Price by adjusting the Bid Price as follows:
- (a) making any correction for errors pursuant to Clause IB.27;
  - (b) excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities, but including competitively priced Daywork; and
  - (c) making an appropriate adjustment for any other acceptable variation or deviation.
- 28.3 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 Bid evaluation.

- 28.4 If Bid of successful bidder is found seriously unbalanced in relation to the Procuring Agency's estimate of cost of work to be performed under the Contract, the Procuring Agency may require the bidder to produce detailed price analyses for any or all items of the Bill of Quantities to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Procuring Agency may require that the amount of the Performance Security set forth in Clause IB.32 be increased at the expense of the successful bidder to a level sufficient to protect the Procuring Agency against financial loss in the event of default of the successful bidder under the Contract.
- 28.5 The Government of Sindh requires that Procuring agency's (including beneficiaries of donor agencies' loans), as well as Bidders/Suppliers/Contractors under Government-financed contracts, observe the highest standard of ethics during the procurement and execution of such contracts. "Corrupt and Fraudulent Practices" means either one or any combination of the practices given below;
- (i) "Coercive Practice" means any impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence the actions of a party to achieve a wrongful gain or to cause a wrongful loss to another party;
  - (ii) "Collusive Practice" means any arrangement between two or more parties to the procurement process or contract execution, designed to achieve with or without the knowledge of the procuring agency to establish prices at artificial, noncompetitive levels for any wrongful gain;
  - (iii) "Corrupt Practice" means the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence the acts of another party for wrongful gain;
  - (iv) "Fraudulent Practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;
  - (v) "Obstructive Practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in a procurement process, or affect the execution of a contract or deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements before investigators in order to materially impede an investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or acts intended to materially impede the exercise of inspection and audit rights provided for under the Rules.

28.6 **Evaluation Report (SPP Rule 45)**

After the completion of evaluation process, as described in the clauses IB 27 IB 28, the procuring agency shall announce the results of bid evaluation in form of report (available on the website of the authority) giving reasons for acceptance and rejection of bid. The report shall be hoisted on website of the authority and that of procuring agency if its website exists and intimated to all bidders at least seven (7) dayd prior to the award of contract.

## **F. AWARD OF CONTRACT**

### **IB.29 Award**

29.1 Subject to Clauses IB.30 and IB.34, the Procuring Agency will award the Contract to the bidder whose bid has been determined to be substantially responsive to the Bidding Documents and who has offered the lowest evaluated Bid Price, provided that such bidder has been determined to be eligible in accordance with the provisions of Clause IB.3 and qualify pursuant to Sub-Clause IB 29.2.

29.2 The Procuring Agency, at any stage of the bid evaluation, having credible reasons for or *prima facie* evidence of any defect in supplier's or contractor's capacities, may require the suppliers or contractors to provide information concerning their professional, technical, financial, legal or managerial competence.

Provided that such qualification shall only be laid down after recording reasons therefor in writing. They shall form part of the records of that bid evaluation report.

### **IB.30 Procuring Agency's Right to Accept any Bid and to Reject any or all Bids**

30.1 Notwithstanding Clause IB.29, the Procuring Agency reserves the right to accept or reject any Bid, and to annul the bidding process and reject all bids, at any time prior to award of Contract, without thereby incurring any liability to the affected bidders or any obligation except that the grounds for rejection of all bids shall upon request be communicated to any bidder who submitted a bid, without justification of grounds. Rejection of all bids shall be notified to all bidders promptly.

### **IB.31 Notification of Award**

31.1 Prior to expiration of the period of bid validity prescribed by the Procuring Agency, the Procuring Agency will notify the successful bidder in writing ("Letter of Acceptance") that his Bid has been accepted. This letter shall name the sum which the Procuring Agency 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 "Contract Price").

31.2 No Negotiation with the bidder having evaluated as lowest responsive or any other bidder shall be permitted, however, Procuring Agency may have clarification meetings to get clarify any item in the bid evaluation report.

31.3 The notification of award and its acceptance by the bidder will constitute the formation of the Contract, binding the Procuring Agency and the bidder till signing of the formal Contract Agreement.

31.4 Upon signing of contract with successful bidder the Procuring Agency will promptly notify the other bidders that their Bids have been unsuccessful and return their bid securities.

31.5 Within seven (7) days of the award of contract, procuring agency shall publish on the website of the authority and on its own website, if such a website exists, the results of the bidding process, identify the bid through procurement identifying numbers, and following information:

- (1) Evaluation Report
- (2) Form of Contract and Letter of Award
- (3) Bill of Quantities or Schedule of Requirement

**31.6 Debriefing (SPP Rule 51)**

(a) A Bidder may ask the Procuring Agency for reasons for non acceptance of his bid and may request for a debriefing meeting and Procuring Agency shall give him the reasons for such non acceptance, either in writing or by holding a debriefing meeting with such a bidder.

(b) The requesting bidder shall bear all the costs of attending such a debriefing.

**IB.32 Performance Security (SPP Rule 39)**

32.1 The successful bidder shall furnish to the Procuring Agency, a performance security of an amount equal to 5% of the contract price in the form of a bank guarantee or pay order or demand draft from any scheduled bank as stipulated in the bidding Data and the Conditions of Contract within fourteen (14) days after the receipt of letter of Acceptance.

32.2 Failure of the successful bidder to comply with the requirements of Sub-Clause IB.32.1 or Clauses IB.33 or IB.35 shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security.

32.3 Validity of performance security shall be one (1) year beyond the date of completion of contract to cover defects liability periods as mentioned in Appendix A to bid subject to final acceptance by the procuring agency.

**IB.33 Signing of Contract Agreement (SPP Rule 39)**

33.1 Within 14 days from the date of furnishing of acceptable Performance Security under the Conditions of Contract, the Procuring Agency will send the successful bidder the Contract Agreement in the form provided in the Bidding Documents, incorporating all agreements between the parties.

33.2 The formal Agreement between the Procuring Agency and the successful bidder shall be executed within 14 days of the receipt of the Contract Agreement by the successful bidder from the Procuring Agency.

33.3 A Procurement contract shall come into force when the Procuring Agency requires signs contract, the date on which the signatures of both the Procuring Agency and the successful bidder are affixed to the written contract. Such affixing of signatures shall take place within the time prescribed in the bidding documents.

Provided that the Procuring Agency may reduce the maximum time limit for signing of contract, as and when required, and shall be mentioned in the bidding documents.

**33.4 Stamp Duty**

The formal agreement between Procuring Agency and the successful bidder shall be duly stamped at the rate of 0.35% of bid price (updated from time to time) stated in the letter of acceptance.

**IB.34 General Performance of the Bidders**

The Procuring Agency may in case of inconsistent/ poor performance of the contractor and his failure to remedy the under performing contract may take such action as may be deemed appropriate under the circumstances of the case including the rescinding the contract and /or black listing of such contractors and debaring him from participation in future bidding process also refer the case of the contractor to the Pakistan Engineering Council (PEC) upon such reference PEC in accordance with its rules, procedures and relevant laws of the land take such actions as may be deemed

appropriate under the circumstances of the case.

**IB.35 Integrity Pact (SPP Rule 89)**

The Bidder shall sign and stamp the Integrity Pact provided at Appendix to Bid in the Bidding Documents for all Provincial/Local Government procurement contracts exceeding Rupees ten million. Failure to provide such Integrity Pact shall make the bidder non-responsive.

**IB.36 Instructions not Part of Contract**

Bids shall be prepared and submitted in accordance with these Instructions which are provided to assist bidders in preparing their bids, and do not constitute part of the Bid or the Contract Documents.

**IB.37 Arbitration (SPP Rule 34)**

Any dispute that is not amicably resolved shall be finally settled, unless otherwise specified in the contract, under the arbitration act 1940 updated from time to time and would be held anywhere in province of Sindh at the discretion of Procuring Agency.

# **BIDDING DATA**

## **BIDDING DATA**

*(This Section should be filled in by the procuring agency before issuance of the bidding documents)* The following specific data for the Works to be bided shall complement, amend, or supplement the provisions in the Instructions to Bidders. Wherever there is a conflict, the provisions herein shall prevail over those in the Instructions to Bidders.

Instructions to Bidders  
Clause Reference

### **1.1 Name and address of the Procuring Agency:**

Sindh Madressatul Islam University,  
Aiwan-e-Tijarat Road, Behind Habib Bank Plaza, Karachi

### **1.2 Name of the Project and Summary of the Works:**

Development of Sindh Madressatul Islam University (SMIU) Campus at Education City Malir, Karachi, (Lot #1 Faculty Block 2 Nos.)

### **2.1 Name of the Borrower/Source of Financing/Funding Agency:**

Federal Government (HEC) PSDP funds.

### **8.1 Time limit for clarification:**

Minimum number of days to seek clarification by the prospective Bidder shall be seven (7) calendar days prior to the Date of Opening of Tender.

### **10.1 Languages:**

English

### **13.1 Bidders to quote entirely in Pak. Rupees.**

### **14.1 Period of Bid validity:**

Bid shall be valid for 90 days from the date of opening of bid.

### **15.1 Amount of Bid Security:**

Bid Security in form of Call Deposit / Pay Order/ Demand Draft of the amount at 2% of the Bid Price in favor of Sindh Madressatul Islam University which shall remain Valid for a period of 28 days beyond the validity period of bids mentioned in para 14.1 above.

### **18.4 Number of copies of the Bid to be completed and returned:**

One Original and One Copy of ALL Bid Documents.



**19.2(a) Procuring Agency's address for the purpose of submission:**

Conference Room No. 2, First Floor, Main Building, Sindh Madressatul Islam University,  
Aiwan-i-Tijarat Road, Behind Habib Bank Plaza, Karachi

**19.2(b) Name and Number of the Contract:**

Development of Sindh Madressatul Islam University (SMIU) Campus at Education City  
Malir, Karachi, (Lot #1, Faculty Block 2 NOS.)

**20.1(a) Deadline for submission of Bids:**

Bids shall be received at Procuring Agency's Address mentioned in para 19.2(a) above  
not later than 15:00 Hours on 18-01-2019.

**23.1 Venue, time, and date of opening:**

Bids shall be opened at 15:30 hours on 18-01-2019

**32.1 Standard form and amount of Performance Security acceptable to the Procuring Agency:**

Performance Security shall be of an amount equal to 5% of the contract price  
submitted in shape of a **bank guarantee or pay order or demand draft** from any  
schedule bank valid till the expiry of defects liability period defined in Appendix-A to  
bid.

**32.2 Stamp Duty**

0.35% of bid price will be paid by successful bidder as stamp duty.

**FORM OF BID  
AND  
APPENDICES TO BID**

## FORM OF BID

**Bid Reference No.**      **Development of Sindh Madressatul Islam University SMIU  
Education City Malir, Karachi, Faculty Block (Lot-1)**

To:

The Project Coordinator  
Sindh Madressatul Islam University,  
Aiwan-i-Tijarat Road,  
Karachi.

Gentleman,

1. Having examined the Bidding Documents including Instructions to Bidders, Bidding Data, Conditions of Contract, Specifications, Drawings and Bill of Quantities and Addenda Nos. \_\_\_\_\_ for the execution of the above-named Works, we, the undersigned, offer to execute and complete such Works and remedy any defects therein in conformity with the Conditions of Contract. Specifications, Drawings, Bill of Quantities and Addenda for the sum of Rs. \_\_\_\_\_ (Rupees \_\_\_\_\_) or such other sum as may be ascertained in accordance with the said conditions.
2. We understand that all the Appendices attached hereto form part of this Bid.
3. As security for due performance of the undertakings and obligations of this Bid, we submit herewith a Bid Security in the amount of Rupees \_\_\_\_\_ (Rs. \_\_\_\_\_) drawn in your favour or made payable to you and valid for a period of \_\_\_\_\_ days beginning from the date bids are opened.
4. 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 Appendix-A to Bid.
5. We agree to abide by this for the period of \_\_\_\_\_ days from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
6. Unless and until a formal Agreement is prepared and executed, this, together with your written acceptance thereof, shall constitute a binding contract between us.
7. We do hereby declare that the Bid is made without any collusion, comparison of figures or arrangement with any other Bidder for the Works.
8. We understand that you are not bound to accept the lowest or any Bid you may receive.

Dated this \_\_\_\_\_ day of \_\_\_\_\_ 20 \_\_\_\_\_

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 \_\_\_\_\_

**SPECIAL STIPULATIONS****Clause  
Conditions of Contract**

For ease of reference, certain information and Special Stipulations applicable to the contract, which are the subject of this Bid, are set forth herein. Where these Conditions conflict with the provisions or requirement set forth elsewhere in the Contract Document, the Conditions as given in Appendix-A to Bid shall govern.

1.	Engineer's Authority to issue Variation in emergency	2.1	—	<b>Not Applicable</b>
2.	Time of submission & Amount Performance Security	10.1	With in <b>14 (Fourteen)</b> calender days of LOA for an amount of <b>5% (five percent)</b> of the contract Amount stated in the LOA in the form of irrevocable bank guarantee or pay order or demand draft from any schedule bank.	
3.	Time for Furnishing Programme	14.1	Within <b>30 (Thirty) calendar days</b> following receipt of the Letter of acceptance (LOA)	
	Time for Furnishing Cash Flow	14.3	Within <b>30 (Thirty) calendar days</b> following receipt of the Letter of acceptance (LOA)	
4.	Minimum amount of Third Party Insurance	23.2	<b>2% (Two Percent)</b> of the contract amount per occurrence. No. of occurrences unlimited.	
5.	Time for Commencement	41.1	Within <b>07 (Seven) calendar days</b> from the date of receipt of Engineer's Notice to Commence which shall be issued within <b>07 (Seven) calendar days</b> after signing of Contract Agreement.	
6.	Time for Completion	43.1, 48.2	<b>18 months</b> from the date of receipt of Engineer's Notice to Commence.	

7.	Amount of Liquidated Damages	47.1	<b>0.075% of the contact value</b> for each day of delay in completion of the Works subject to a <b>maximum of 10% of Contract Price</b> stated in the Letter of Acceptance.	
8.	Defects Liability Period	49.1	<b>12 months</b> from the effective date of Taking Over Certificate.	
9.	Percentage of Retention Money	60.2	<b>5%</b> of the amount of Interim/running Payments	
10.	Limit of Retention Money	60.2	<b>5%</b> of Contract Price to be stated in the letter of acceptance.	
11.	Minimum amount of Interim Payment Certificates (Running Bills)	60.2	—	<b>Not Applicable</b>
12.	Time of Payment from delivery of Engineer's Interim Payment Certificate to the Procuring Agency	60.10	28 days in case of local currency.	
13.	Mobilization Advance * (Interest Free)	60.12	—	<b>Not Applicable</b>

Appendix-B to Bid

**FOREIGN CURRENCY REQUIREMENTS**

1. The Bidder may indicate here in below his requirements of foreign currency (if any), with reference to various inputs to the Works.
2. Foreign Currency Requirement as percentage of the price excluding Provisional Sums \_\_\_\_\_%.
3. Table of Exchange Rates

Not applicable

<b>Unit of Currency</b>	<b>Equivalent in Pak. Rupees</b>
Australian Dollar	-----
Euro	-----
Japanese Yen	-----
U.K. Pound	-----
U.S. Dollars	-----
-----	-----
-----	-----

## Appendix-C to Bid

**PRICE ADJUSTMENT UNDER CLAUSE 70  
OF CONDITIONS OF CONTRACT**

The source of indices and the weightages or coefficients for use in the adjustment formula under Clause 70 shall be as follows:

(To be filled by the Procuring Agency)

Cost Element	Description	Weightages	Applicable index
1	2	3	4
(i)	Fixed Portion	0.60	Government of Pakistan (GP) Federal Bureau of Statistics (FBS) Monthly Statistical Bulletin.
(ii)	Local Labour**	0.20	
(iii)	Cement – in bags	0.06	
(iv)	Reinforcing Steel	0.12	
(v)	High Speed Diesel (HSD)	0.02	
	Total	<b>1.00</b>	

\*\* Percentage increase in the cost of Unskilled Labour as arrived from the above Monthly

Statistical Bulletin shall be applicable to the Skilled Labour of any trade as well. Unskilled Labour wages represent that of skilled labour wages of all categories.

**Notes:**

- 1) Indices for "(i)" to "(v)" are taken from the Government of Pakistan Federal Bureau of Statistics, Monthly Statistical Bulletin. The base cost indices or prices shall be those applying 28 days prior to the latest day for submission of bids. Current indices or prices shall be those applying 28 days prior to the last day of the billing period.
- 2) Any fluctuation in the indices or prices of materials other than those given above shall not be subject to adjustment of the Contract Price.
- 3) Any price adjustment shall be worked out only by taking the difference between the base cost indices or prices stated in the Government of Pakistan Federal Bureau of Statistics, Monthly Statistical Bulletin 28 days prior to the latest day for submission of bids and those indices or prices applying 28 days prior to the last day of the billing period taken from.

The actual amount of above stated adjustments shall be calculated as stipulated in clauses 70.1 of the Particular Conditions.



**BD-1**

**Appendix-D to Bid**

**BILL OF QUANTITIES**

**See separate volume - III**

**BE-1**

**Appendix-E to Bid**

**PROPOSED CONSTRUCTION SCHEDULE**

Pursuant to Sub-Clause 43.1 of the General Conditions of Contract, the Works shall be completed on or before the date stated in Appendix-A to Bid. The Bidder shall provide as Appendix-E to Bid, 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 which he proposes to complete each work item in such a manner that his proposed programme for completion of the whole of the Works and parts of the Works may meet Procuring Agency's completion targets in days noted below and counted from the date of receipt of Engineer's Notice to Commence (Attach sheets as required for the specified form of Construction Schedule):

<b><u>Description</u></b>	<b><u>Time for Completion</u></b>
a) Whole Works	_____ days
b) Part-A	_____ days
c) Part-B	_____ days
d) _____	_____ days
e) _____	_____ days

**BF-1**

**Appendix-F to Bid**

**METHOD OF PERFORMING THE WORK**

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

1. Organization Chart indicating 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 be used.
3. The method of executing the Works, the procedures for installation of equipment and machinery and transportation of equipment and materials to the site.]

**BG-1**

**Appendix-G to Bid**

**LIST OF MAJOR EQUIPMENT – RELATED ITEMS**

[The Bidder will provide on Sheet 2 of this Appendix 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.]

BG-2

Appendix-G to Bid

LIST OF MAJOR EQUIPMENT

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

**BH-1**

**Appendix-H to Bid**

**CONSTRUCTION CAMP AND HOUSING FACILITIES**

The Contractor shall provide description of his construction camp's facilities and staff housing requirements.

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.

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

1. Site Preparation (clearing, land preparation, etc.).
2. Provision of Services.
  - a) 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 of construction 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.).

**BI-1**

**Appendix-I 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.

<b>Part of Works (Give Details)</b>	<b>Subcontractor (With Complete Address)</b>
<b>1</b>	<b>2</b>

**BJ-1**

**Appendix-J 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 Pakistani Rupees:

<b>Quarter/ Year/ Period</b>	<b>Amounts (1,000 Rs.)</b>
<b>1</b>	<b>2</b>
1 <sup>st</sup> Quarter	
2 <sup>nd</sup> Quarter	
3 <sup>rd</sup> Quarter	
4 <sup>th</sup> Quarter	
5 <sup>th</sup> Quarter	
6 <sup>th</sup> Quarter	
7 <sup>th</sup> Quarter	
8 <sup>th</sup> Quarter	
9 <sup>th</sup> Quarter	
<b>Bid Price</b>	



**BK-1**

**Appendix-K to Bid**

**ORGANIZATION CHART  
FOR THE  
SUPERVISORY STAFF AND LABOUR**

Appendix-L to Bid

**(INTEGRITY PACT)**

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

Contract No. \_\_\_\_\_ Dated \_\_\_\_\_  
Contract Value: \_\_\_\_\_  
Contract Title: \_\_\_\_\_

..... [name of Supplier] hereby declares that it has not obtained or induced the procurement of any contract, right, interest, privilege or other obligation or benefit from Government of 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 Supplier] represents and warrants that it has fully declared the brokerage, commission, fees etc. paid or payable to anyone and not given or agreed to give and shall not give or agree to give to anyone within or outside Pakistan either directly or indirectly through any natural or juridical person, including its affiliate, agent, associate, broker, consultant, director, promoter, shareholder, sponsor or subsidiary, any commission, gratification, bribe, finder's fee or kickback, whether described as consultation fee or otherwise, with the object of obtaining or inducing the procurement of a contract, right, interest, privilege or other obligation or benefit in whatsoever form from GoP, except that which has been expressly declared pursuant hereto.

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

[name of Supplier] accepts full responsibility and strict liability for making any false declaration, not making full disclosure, misrepresenting facts or taking any action likely to defeat the purpose of this declaration, representation and warranty. It agrees that any contract, right, interest, privilege or other obligation or benefit obtained or procured as aforesaid shall, without prejudice to any other rights and remedies available to 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 Supplier] 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 times the sum of any commission, gratification, bribe, finder's fee or kickback given by [name of Supplier] as aforesaid for the purpose of obtaining or inducing the procurement of any contract, right, interest, privilege or other obligation or benefit in whatsoever form from GoP.

Name of Buyer: .....  
Signature: .....  
[Seal]

Name of Seller/Supplier: .....  
Signature: .....  
[Seal]

## **FORMS**

**BID SECURITY  
PERFORMANCE SECURITY  
CONTRACT AGREEMENT  
MOBILIZATION ADVANCE GUARANTEE/BOND**

**BID SECURITY**  
**(Bank Guarantee)**

(On the required value of non-judicial Stamp Paper of the Government of Pakistan)

Security Executed on \_\_\_\_\_  
(Date)

Name of Surety (Bank) with Address: \_\_\_\_\_  
(Scheduled Bank in Pakistan)

Name of Principal (Bidder) with Address \_\_\_\_\_

Penal Sum of Security Rupees. \_\_\_\_\_ (Rs. \_\_\_\_\_)

Bid Reference No. \_\_\_\_\_

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bid and at the request of the said Principal (Bidder) we, the Surety above named, are held and firmly bound unto

\_\_\_\_\_ (hereinafter called the 'Procuring Agency') in the sum stated above for the payment of which sum well and truly to be made, 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 Bidder has submitted the accompanying Bid dated \_\_\_\_\_ for Bid No. \_\_\_\_\_ for \_\_\_\_\_ (Particulars of Bid) to the said Procuring Agency; and

WHEREAS, the Procuring Agency has required as a condition for considering said Bid that the Bidder furnishes a Bid Security in the above said sum from a Scheduled Bank in Pakistan or from a foreign bank duly counter-guaranteed by a Scheduled Bank in Pakistan, to the Procuring Agency, conditioned as under:

- (1) that the Bid Security shall remain in force up to and including the date 28 days after the deadline for validity of bids as stated in the Instructions to Bidders or as it may be extended by the Procuring Agency, notice of which extension(s) to the Surety is hereby waived;
- (2) that the Bid Security of unsuccessful Bidders will be returned by the Procuring Agency after expiry of its validity or upon signing of the Contract Agreement; and
- (3) that in the event of failure of the successful Bidder to execute the proposed Contract Agreement for such work and furnish the required Performance Security, the entire said sum be paid immediately to the said Procuring Agency pursuant to Clause 15.6 of the Instruction 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 Procuring Agency 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 Procuring Agency 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 to remain in full force and effect.

**BS-2**

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

PROVIDED ALSO THAT the Procuring Agency shall be the sole and final judge for deciding 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 Procuring Agency 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 (Bank)

WITNESS:

1. \_\_\_\_\_

\_\_\_\_\_

Corporate Secretary (Seal)

2. \_\_\_\_\_

\_\_\_\_\_

Name, Title & Address

Signature \_\_\_\_\_

Name \_\_\_\_\_

Title \_\_\_\_\_

Corporate Guarantor (Seal)

**FORM OF PERFORMANCE SECURITY  
(Bank Guarantee)**

Guarantee No. \_\_\_\_\_  
Executed on \_\_\_\_\_  
Expiry date \_\_\_\_\_

[Letter by the Guarantor to the Procuring Agency]

Name of Guarantor (Bank) with address: \_\_\_\_\_  
(Scheduled Bank in Pakistan)

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 request of the said Principal we, the Guarantor above named, are held and firmly bound unto the \_\_\_\_\_ (hereinafter called the Procuring Agency) in the penal sum of the amount stated above for the payment of which sum well and truly to be made to the said Procuring Agency, 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 the Procuring Agency'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 the said Documents and any extensions thereof that may be granted by the Procuring Agency, with or without notice to the Guarantor, which notice is, hereby, waived and shall also well and truly perform and fulfill 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 Clause 49, Defects Liability, 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 any liability 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, if any, under this Guarantee.

We, \_\_\_\_\_ (the Guarantor), waiving all objections and defenses under the Contract, do hereby irrevocably and independently guarantee to pay to the Procuring Agency without delay upon the Procuring Agency's first written demand without cavil or arguments and without requiring the Procuring Agency to prove or to show grounds or reasons for such demand any sum or sums up to the amount stated above, against the Procuring Agency's written declaration that the Principal has refused or failed to perform the obligations under the Contract which payment will be effected by the Guarantor to Procuring Agency's designated Bank & Account Number.

**PS-2**

PROVIDED ALSO THAT the Procuring Agency shall be the sole and final judge for deciding whether the Principal (Contractor) has duly performed his obligations under the Contract or has defaulted in fulfilling said obligations and the Guarantor shall pay without objection any sum or sums up to the amount stated above upon first written demand from the Procuring Agency forthwith and without any reference to the Principal or any other person.

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

	_____
	Guarantor (Bank)
Witness:	
1. _____	Signature _____
_____	Name _____
Corporate Secretary (Seal)	Title _____
2. _____	
_____	_____
Name, Title & Address	Corporate Guarantor (Seal)

CA-1

**FORM OF CONTRACT AGREEMENT**

THIS CONTRACT AGREEMENT (hereinafter called the "Agreement") made on the \_\_\_\_\_ day of \_\_\_\_\_ (month) 20\_\_\_\_ between \_\_\_\_\_ (hereafter called the "Procuring Agency") of the one part and \_\_\_\_\_ (hereafter called the "Contractor") of the other part.

WHEREAS the Procuring Agency is desirous that certain Works, viz \_\_\_\_\_ should be executed by the Contractor and has accepted a Bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein.

NOW this Agreement witnesseth as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.
2. The following documents after incorporating addenda, if any, except those parts relating to Instructions to Bidders shall be deemed to form and be read and construed as part of this Agreement, viz:
  - (a) The Contract Agreement;
  - (b) The Letter of Acceptance;
  - (c) The completed Form of Bid;
  - (d) Special Stipulations (Appendix-A to Bid);
  - (e) The Particular Conditions of Contract – Part II;
  - (f) The General Conditions – Part I;
  - (g) The completed Appendices to Bid (B, C, E to L);
  - (h) The Drawings;
  - (i) The Specifications; and
  - (j) Any other document forming part of the Contract
3. In consideration of the payments to be made by the Procuring Agency to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Procuring Agency to execute and complete the Works and remedy defects therein in conformity and in all respects with the provisions of the Contract.
4. The Procuring Agency 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 sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS WHEREOF the parties hereto have caused this Agreement to be executed on the day, month and year first before written in accordance with their respective laws.

Signature of the Contactor

\_\_\_\_\_  
(Seal)

Signature of Procuring Agency

\_\_\_\_\_  
(Seal)



**CA-2**

Signed, Sealed and Delivered in the presence of:

Witness:

\_\_\_\_\_

(Name, Title and Address)

Witness:

\_\_\_\_\_

(Name, Title and Address)

MG-1

**MOBILIZATION ADVANCE GUARANTEE  
(Bank Guarantee)**

Guarantee No. \_\_\_\_\_ Date \_\_\_\_\_

WHEREAS \_\_\_\_\_ (hereinafter called the 'Procuring Agency') has entered into a Contract for \_\_\_\_\_  
(Particulars of Contract)  
with \_\_\_\_\_ (hereinafter called the "Contractor").

AND WHEREAS, the Procuring Agency has agreed to advance to the Contractor, at the Contractor's request, an amount of Rupees \_\_\_\_\_ (Rs \_\_\_\_\_) which amount shall be advanced to the Contractor as per provisions of the Contract.

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

AND WHEREAS, \_\_\_\_\_  
(Scheduled Bank of Pakistan)  
(hereinafter called the "Guarantor") at the request of the Contractor and in consideration of the Procuring Agency 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 the Procuring Agency for payment not exceeding the aforementioned amount.

Notice in writing of any default, of which the Procuring Agency shall be the sole and final judge, on the part of the Contractor, shall be given by the Procuring Agency 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 the Interim Payment Certificates of the Contractor or until \_\_\_\_\_  
(Date) \_\_\_\_\_ whichever is earlier.

The Guarantor's liability under this Guarantee shall not in any case exceed the sum of Rupees \_\_\_\_\_ (Rs \_\_\_\_\_).

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 above mentioned date the advance payment is not fully adjusted.

GUARANTOR

1. Signature \_\_\_\_\_
2. Name \_\_\_\_\_
3. Title \_\_\_\_\_

WITNESS

1. \_\_\_\_\_  
\_\_\_\_\_  
Corporate Secretary (Seal)
2. \_\_\_\_\_  
(Name Title & Address)

\_\_\_\_\_  
Corporate Guarantor (Seal)

**NOT APPLICABLE**

## INDENTURE FOR SECURED ADVANCES.

(For use in cases in which is contract is for finished work and the contractor has entered into an agreement for the execution of a certain specified quantity of work in a given time).

This INDENTURE made the ..... day of .....  
20..... BETWEEN (hereinafter called "the Contractor" which expression shall where the context so admits or implied be deemed to include his heirs, executors, administrators and assigns) of the one part and THE GOVERNOR OF SINDH (hereinafter called "the Government" of the other part).

WHEREAS by an agreement, dated (hereinafter called the said agreement, the contractor has agreed to perform the under-mentioned works (hereinafter referred to as the said work):- (Here enter (the description of the works).

AND WHEREAS the contractor has applied to the .....  
.....for an advance to him of Rupees ..... (Rs. ....) on the security of materials absolutely belonging to him and brought by him to the site of the said works the subject of the said agreement for use in the construction of such of the said works as he has undertaken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charge) AND WHEREAS the Government has agreed to advance to the Contractor the sum of Rupees, (Rs. ....) on the security of materials the quantities and other particulars of which are detailed in Part II of Running Account Bill (B). the said works signed by the contractor

On ..... and on such covenants and conditions as are hereinafter contained and the Government has reserved to itself the option of marking any further advance or advances on the security of other materials brought by the Contractor to the site of the said works.

NOW THIS INDENTURE WTTNESSETH that in pursuance of the said agreement and in consideration of the sum of Rupees..... (Rs. ....) on or before the execution of these presents paid to the Contractor by the Government (the receipt whereof the Contractor doth hereby acknowledge) and of such further advances (if any) as may be made to him as aforesaid (all of which advances are hereinafter collectively referred to as the said amount) the Contractor doth hereby assign unto the Government the said materials by way of security for the said amount

And doth hereby covenant and agree with the Government and declare ay follow :-

- (1) That the said sum of Rupees. .... RS. .... ) so advanced by the Government to the Contractor as aforesaid and all or any further sum or sums which may be advanced as aforesaid shall be employed by the contractor in or towards expending the execution of the said works and for no other purpose whatsoever.
- (2) That the materials detailed in the said Running Account Bill (B) which have been offered to and accepted by (he Government as security for the said amount are (73) absolutely by the Contractors own property free from encumbrances of any kind and the Contractor will not make any application for or receive a further advance on the security of materials which are not absolutely his own property and free from encumbrances of any kind and the contractor hereby agrees, at all times, to indemnify and save harmless the Government against all claims whatsoever to any materials in respect of which an advance has been made to him as aforesaid.

- (3) That the said materials detailed in the said Running Account Bill (B) and all other materials on the security of which any further advance or advances may hereafter be made as aforesaid (hereinafter called the said materials) shall be used by the Contractor solely in the execution of the said works in accordance with the directions of the Divisional Officer (hereinafter called the Divisional Officer) and in the terms of the said agreement.
- (4) That the Contractor shall make at his own cost all necessary and adequate arrangement for the proper watch, safe custody and protection against all risks of the said material and that until used in construction as aforesaid the said materials shall remain at the site of the said works in the Contractor's custody and at his own risk and on his own responsibility and shall at all times be open to inspection by (the Divisional Officer or any officer authorized by him. In the event of the said materials of any part (hereof being stolen, destroyed or damaged or becoming deteriorated in a greater degree than is due to reasonable use and wear thereof Contractor will forthwith replace the same with other materials of like quality or repair and make good the same as required by the Divisional Officer and the materials so brought to replace the said materials so repaired and made good shall also be considered as security for the said amount.
- (5) That the said materials shall not on any account be removed from the site of the said works except with the written permission of the Divisional Officer or an officer authorized by him in that behalf
- (6) That the said amount shall be payable in full when or before the Contractor receives payment, from the Government of the price payable to him for the said works under the terms and provisions of the said agreement PROVIDED THAT if any intermediate payments are made to the contractor on account of work done then on the occasion of each such payment the Government will be at liberty to make a recovery from the Contractor's Bill for such payment by deducting therefrom the value of the said materials (then actually used in the construction and in respect of which recovery has not been made previously the value for this purpose being determined in respect of each description of material at the rates at which the amount of the advances made under these presents were calculated.
- (7) That if the Contractor shall at any time make any default in the performance or observation in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances that may still be owing to the Government shall immediately on the happening of such default be repayable by the Contractor to the Government together with interest thereon at twelve percent per annum from the date or respective dates of such advance or advances to the date of repayment and with all costs, charges, damages and expenses incurred by the Government in or for the recovery thereof or the (74) enforcement of this security or otherwise by reason of (the default of the Contractor and any moneys so becoming due and payable shall constitute a debt due from the Contractor to the Government and the Contractor hereby covenants and agrees with the Government to repay and the same respectively to it accordingly.
- (8) That the Contractor hereby charges all the said materials with the repayment to the Government of the said sum of Rupees..... (Rs. .... ) and any further sum or sums which may be advanced as aforesaid and all costs charges damages and expenses payable under these presents PROVIDED ALWAYS and it is hereby agreed and declared that not, withstanding anything in the said agreement and without prejudice to the powers contained therein if and whether the covenant for payment and repayment hereinbefore contained shall become enforceable and the money owing shall not be paid to accordingly.

Once there with the Government may at any time thereafter adopt all or any of following courses as it may deem best ;-

- a. Seize and utilize the said materials or any part thereof in the completion of the said works on behalf of the Contractor in accordance with the provisions in that behalf contained in the said agreement debiting the Contractor with the actual cost of effecting such completion the amount due in respect of advances under these presents and crediting the Contractor with the value of work done as he had carried it out in accordance with the said agreement and at the rates thereby provided. If the balance is against the Contractor he is to pay the same to the Government on demand.
  - b. Remove and sell by public auction the seized materials or any part thereof and out of the moneys arising from the sale retain all the sums aforesaid repayable to the Government under these presents and pay over the surplus (if any) to the Contractor.
  - c. Deduct all or any part of the moneys owing out of the security deposit or any sum due to the Contractor under the said agreement.
- (9) That except as is expressly provided by the presents interest on the said advance shall not be payable.
- (10) That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been hereinbefore expressly provided for the same shall be referred to the Superintending Engineer/Executive District Officer/Officer one grade higher to officer signed the agreement whose..... decision shall be final and the provisions of the Arbitration Act 1940 for the time being in force so far as they are applicable shall apply to any such reference.

**Signed, sealed and delivered by\***

In the presence of 1 st witness

2nd witness \*

# **PART 1 - GENERAL CONDITIONS**

# **GENERAL CONDITIONS OF CONTRACT**

**PREPARED BY**

**THE PAKISTAN ENGINEERING COUNCIL**

**(VERSION NOVEMBER 2007) FOR**

**THE WORKS OF**

**CIVIL ENGINEERING CONSTRUCTION**

**Bidder is supposed  
to possess a copy  
with him**



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## PART II - PARTICULAR CONDITIONS OF CONTRACT

### 1.1 Definitions

- (a) (i) The Procuring Agency is **Sindh Madressatul Islam University, Aiwan-e-Tijarat Road, Karachi**
- (a) (iv) The Engineer is **EA Consulting Pvt. Ltd. , AL-9, 15<sup>th</sup> Lane, Khayaban-e-Hilal, Phase-VII, DHA, Karachi.**

The following paragraph is added:

- (a) (vi) "Bidder or Tenderer" means any person or persons, company, corporation, firm or joint venture submitting a Bid or Tender.

- (b) (v) The following is added at the end of the paragraph:

The word "Tender" is synonymous with "Bid" and the word "Tender Documents" with "Bidding Documents".

The following paragraph is added:

- (b) (ix) "Programme" means the programme to be submitted by the Contractor in accordance with Sub-Clause 14.1 and any approved revisions thereto.

- (e) (i) The text is deleted and substituted with the following:

"Contract Price" means the sum stated in the Letter of Acceptance as payable to the Contractor for the execution and completion of the Works subject to such additions thereto or deductions therefrom as may be made and remedying of any defects therein in accordance with the provisions of the Contract.

### 2.1 Engineer's Duties and Authority

With reference to Sub-Clause 2.1 (b), the following provisions shall also apply;

The Engineer shall obtain the specific approval of the Procuring Agency before carrying out his duties in accordance with the following Clauses:

- (i) Consenting to the sub-letting of any part of the Works under Sub-Clause 4.1 "Subcontracting".
- (ii) Certifying additional cost determined under Sub-Clause 12.2 "Not Foreseeable Physical Obstructions or Conditions".
- (iii) Any action under Clause 10 "Performance Security" and Clauses 21, 23, 24 & 25 "Insurance" of sorts.
- (iv) Any action under Clause 40 "Suspension".
- (v) Any action under Clause 44 "Extension of Time for Completion".
- (vi) Any action under Clause 47 "Liquidated Damages for Delay" or Payment of Bonus for Early Completion of Works (PCC Sub-Clause 47.3).
- (vii) Issuance of "Taking Over Certificate" under Clause 48.

- (viii) Issuing a Variation Order under Clause 51, except:
  - a) in an emergency\* situation, as stated herebelow, or
  - b) if such variation would increase the Contract Price by less than the amount stated in the Appendix-A to Bid.
- (ix) Fixing rates or prices under Clause 52.
- (x) Extra payment as a result of Contractor's claims under Clause 53.
- (xi) Release of Retention Money to the Contractor under Sub-Clause 60.3 "Payment of Retention Money".
- (xii) Issuance of "Final Payment Certificate" under Sub-Clause 60.8.
- (xiii) Issuance of "Defect Liability Certificate" under Sub-Clause 62.1.
- (xiv) Any change in the ratios of Contract currency proportions and payments thereof under Clause 72 "Currency and Rate of Exchange".

(Note: Procuring Agency may further vary according to need of the project)

\* (If in the opinion of the Engineer an emergency occurs affecting the safety of life or of the Works or of adjoining property, the Engineer may, without relieving the Contractor of any of his duties and responsibilities 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 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 52 and shall notify the Contractor accordingly, with a copy to the Procuring Agency.)

## **2.2 Engineer's Representative**

The following paragraph is added:

The Procuring Agency shall ensure that the Engineer's Representative is a professional engineer as defined in the Pakistan Engineering Council Act 1975 (V of 1976)

The following Sub-Clauses 2.7 and 2.8 are added:

## **2.7 Engineer Not Liable**

Approval, reviews and inspection by the Engineer of any part of the Works does not relieve the Contractor from his sole responsibility and liability for the supply of materials, plant and equipment for construction of the Works and their parts in accordance with the Contract and neither the Engineer's authority to act nor any decision made by him in good faith as provided for under the Contract whether to exercise or not to exercise such authority shall give rise to any duty or responsibility of the Engineer to the Contractor, any Subcontractor, any of their representatives or employees or any other person performing any portion of the Works.

## **2.8 Replacement of the Engineer**

"If the Procuring Agency intends to replace the Engineer, the Procuring Agency shall, not less than 14 days before the intended date of replacement, give notice to the Contractor, of the name, address and relevant experience of the intended replacement Engineer. The Procuring Agency shall not replace the Engineer with a person against whom the Contractor raises reasonable objection by notice to the Procuring Agency, with supporting particulars."

## **5.1 Language(s) and Law**

- (a) The Contract Documents, shall be drawn up in the English language.
- (b) The Contract shall be subject to the Laws of Islamic Republic of Pakistan.

## **5.2 Priority of Contract Documents**

The documents listed at (1) to (6) of the Sub-Clause are deleted and substituted with the following:

- (1) The Contract Agreement (if completed);
- (2) The Letter of Acceptance;
- (3) The completed Form of Bid;
- (4) Special Stipulations (Appendix-A to Bid);
- (5) The Particular Conditions of Contract – Part II;
- (6) The General Conditions – Part I;
- (7) The priced Bill of Quantities (Appendix-D to Bid);
- (8) The completed Appendices to Bid (B, C, E to L);
- (9) The Drawings;
- (10) The Specifications; and
- (11) \_\_\_\_\_ (any other).

In case of discrepancies between drawings, those of larger scale shall govern unless they are superseded by a drawing of later date regardless of scale. All Drawings and Specifications shall be interpreted in conformity with the Contract and these Conditions. Addendum, if any, shall be deemed to have been incorporated at the appropriate places in the documents forming the Contract.

The following Sub-Clauses 6.6 and 6.7 are added:

### **6.6 Shop Drawings**

The Contractor shall submit to the Engineer for review 3 copies of 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 be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory and that the Engineer's review or approval shall not relieve the Contractor of any of his responsibilities under the Contract.

### **6.7 As-Built Drawings**

At the completion of the Works under the Contract, the Contractor shall furnish to the Engineer 6 copies and one reproducible of all drawings amended to conform with the Works as built. The price of such Drawings shall be deemed to be included in the Contract Price.

## **10.4 Performance Security Binding on Variations and Changes**

The Performance Security shall be binding irrespective of changes in the quantities or variations in the Works or extensions in Time for Completion of the Works which are granted or agreed upon under the provisions of the Contract.

## **14.1 Programme to be Submitted**

The programme shall be submitted within 14 days from the date of receipt of Letter of Acceptance, which shall be in the form of:

- i) a Bar Chart identifying the critical activities.
- ii) a CPM identifying the critical path/activities.  
*(Procuring Agency to select appropriate one)*

## **14.3 Cash Flow Estimate to be Submitted**

The detailed Cash Flow Estimate shall be submitted within 14 days from the date of receipt of Letter of Acceptance

The following Sub-Clause 14.5 is added:

## **14.5 Detailed Programme and Monthly Progress Report**

- a) For purposes of Sub-Clause 14.1, the Contractor shall submit to the Engineer detailed programme for the following:
  - (1) Execution of Works;
  - (2) Labour Employment;
  - (3) Local Material Procurement;
  - (4) Material Imports, if any; and
  - (5) Other details as required by the Engineer.
- (b) During the period of the Contract, the Contractor shall submit to the Engineer not later than the 8<sup>th</sup> day of the following month, 10 copies each of Monthly Progress Reports covering:
  - (1) A Construction Schedule indicating the monthly progress in percentage;
  - (2) Description of all work carried out since the last report;
  - (3) Description of the work planned for the next 56 days sufficiently detailed to enable the Engineer to determine his programme of inspection and testing;
  - (4) Monthly summary of daily job record;
  - (5) Photographs to illustrate progress ;and
  - (6) Information about problems and difficulties encountered, if any, and proposals to overcome the same.
- (c) During the period of the Contract, the Contractor shall keep a daily record of the work progress, which shall be made available to the Engineer as and when requested. The daily record shall include particulars of weather conditions, number of men working, deliveries of materials, quantity, location and assignment of Contractor's equipment.

The following Sub-Clauses 15.2 and 15.3 are added:

## **15.2 Language Ability of Contractor's Representative**

The Contractor's authorised representative shall be fluent in the English language. Alternately an interpreter with ability of English language shall be provided by the Contractor on full time basis.

## **15.3 Contractor's Representative**

The Contractor's authorised representative and his other professional engineers working at Site shall register themselves with the Pakistan Engineering Council.

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

The following Sub-Clauses 16.3 and 16.4 are added:

## **16.3 Language Ability of Superintending Staff of Contractor**

A reasonable proportion of the Contractor's superintending staff shall have a working knowledge of the English language. If the Contractor's superintending staff are not fluent in English language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer.

## **16.4 Employment of Local Personnel**

The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labour from sources within Pakistan.

The following Sub-Clauses 19.3 and 19.4 are added:

## **19.3 Safety Precautions**

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 authorise 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 make, maintain and submit reports to the Engineer concerning safety, health and welfare of persons and damage to property, as the Engineer may from time to time prescribe.

## **19.4 Lighting Work at Night**

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 and the 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's Representative.



## 20.4 Procuring Agency's Risks

The Procuring Agency's risks are:

Delete the text and substitute with the following:

- (a) insofar as they directly affect the execution of the Works in Pakistan:
  - (i) war and hostilities (whether war be declared or not), invasion, act of foreign enemies,
  - (ii) rebellion, revolution, insurrection, or military or usurped power, or civil war,
  - (iii) ionizing radiations, or contamination by radioactivity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radioactive toxic explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof,
  - (iv) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds,
  - (v) riot, commotion or disorder, unless solely restricted to the employees of the Contractor or of his Subcontractors and arising from the conduct of the Works;
- (b) loss or damage due to the use or occupation by the Procuring Agency of any Section or part of the Permanent Works, except as may be provided for in the Contract;
- (c) loss or damage to the extent that it is due to the design of the Works, other than any part of the design provided by the Contractor or for which the Contractor is responsible; and
- (d) any operation of the forces of nature (insofar as it occurs on the Site) which an experienced contractor:
  - (i) could not have reasonably foreseen, or
  - (ii) could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures:
    - (a) prevent loss or damage to physical property from occurring by taking appropriate measures, or
    - (b) insure against.

## 21.4 Exclusions

The text is deleted and substituted with the following:

There shall be no obligation for the insurances in Sub-Clause 21.1 to include loss or damage caused by the risks listed under Sub-Clause 20.4 paras (a) (i) to (iv).

The following Sub-Clause 25.5 is added:

## **25.5 Insurance Company**

The Contractor shall be obliged to place all insurances relating to the Contract (including, but not limited to, the insurances referred to in Clauses 21, 23 and 24) with either National Insurance Company of Pakistan or any other insurance company operating in Pakistan and acceptable to the Procuring Agency.

Costs of such insurances shall be borne by the Contractor.

The following Sub-Clause 31.3 is added:

## **31.3 Co-operation with other Contractors**

During the execution of the Works, the Contractor shall co-operate fully with other contractors working for the Procuring Agency at and in the vicinity of the Site and also shall provide adequate precautionary facilities not to make himself a nuisance to local residents and other contractors.

The following Sub-Clauses 34.2 to 34.12 are added:

## **34.2 Rates of Wages and Conditions of Labour**

The Contractor shall pay rates of wages and observe conditions of labour not less favourable than those established for the trade or industry where the work is carried out. In the absence of any rates of wages or conditions of labour so established, the Contractor shall pay rates of wages and observe conditions of labour which are not less favourable than the general level of wages and conditions observed by other Procuring Agencies whose general circumstances in the trade or in industry in which the Contractor is engaged are similar.

## **34.3 Employment of Persons in the Service of Others**

The Contractor shall not recruit his staff and labour from amongst the persons in the services of the Procuring Agency or the Engineer; except with the prior written consent of the Procuring Agency or the Engineer, as the case may be.

## **34.4 Housing for Labour**

Save insofar as the Contract otherwise provides, the Contractor shall provide and maintain such housing accommodation and amenities as he may consider necessary for all his supervisory staff and labour, employed for the purposes of or in connection with the Contract including all fencing, electricity supply, sanitation, cookhouses, fire prevention, water supply and other requirements in connection with such housing accommodation or amenities. On completion of the Contract, these facilities shall be handed over to the Procuring Agency or if the Procuring Agency so desires, the temporary camps or housing provided by the Contractor shall be removed and the Site reinstated to its original condition, all to the approval of the Engineer.

### **34.5 Health and Safety**

Due precautions shall be taken by the Contractor, and at his own cost, to ensure the safety of his staff and labour at all times throughout the period of the Contract. The Contractor shall further ensure that suitable arrangements are made for the prevention of epidemics and for all necessary welfare and hygiene requirements.

### **34.6 Epidemics**

In the event of any outbreak of illness of an 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 purpose of dealing with and overcoming the same.

### **34.7 Supply of Water**

The Contractor shall, so far as is reasonably practicable, having regard to local conditions, provide on the Site, to the satisfaction of the Engineer or his representative, adequate supply of drinking and other water for the use of his staff and labour.

### **34.8 Alcoholic Liquor or Drugs**

The Contractor shall not, otherwise than in accordance with the Statutes, Ordinances and Government Regulations or Orders for the time being in force, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or suffer any such importation, sale, gift, barter or disposal by his Subcontractors, agents, staff or labour.

### **34.9 Arms and Ammunition**

The Contractor shall not give, or otherwise dispose of to any person or persons, any arms or ammunition of any kind or permit or suffer the same as aforesaid.

### **34.10 Festivals and Religious Customs**

The Contractor shall in all dealings with his staff and labour have due regard to all recognised festivals, days of rest and religious and other customs.

### **34.11 Disorderly Conduct**

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst staff and labour and for the preservation of peace and protection of persons and property in the neighbourhood of the Works against the same.

### **34.12 Compliance by Subcontractors**

The Contractor shall be responsible for compliance by his Subcontractors of the provisions of this Clause.

The following Sub-Clauses 35.2 and 35.3 are added:

### **35.2 Records of Safety and Health**

The Contractor shall maintain such records and make such reports concerning safety, health and welfare of persons and damage to property as the Engineer may from time to time prescribe.

### **35.3 Reporting of Accidents**

The Contractor shall report to the Engineer details of any accident as soon as possible after its occurrence. In the case of any fatality or serious accident, the Contractor shall, in addition, notify the Engineer immediately by the quickest available means.

The following Sub-Clause 36.6 is added:

### **36.6 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.

### **41.1 Commencement of Works**

The text is deleted and substituted with the following:

The Contractor shall commence the Works on Site within the period named in Appendix-A to Bid from the date of receipt by him from the Engineer of a written Notice to Commence. Thereafter, the Contractor shall proceed with the Works with due expedition and without delay.

The following Sub-Clause 47.3 is added:

### **47.3 Bonus for Early Completion of Works**

The Contractor shall in case of earlier completion for either whole or part(s) of the Works pursuant to Sub-Clauses 48.1 and 48.2 respectively of the General Conditions of Contract, be paid bonus up to the limit and at a rate equivalent to 50% of the relevant limit and rate of liquidated damages prescribed in Appendix-A to Bid "Special Stipulations".

### **48.2 Taking Over of Sections or Parts**

For the purposes of para (a) of this Sub-Clause, separate Times for Completion shall be provided in the Appendix-A to Bid "Special Stipulations".

### **51.2 Instructions for Variations**

At the end of the first sentence, after the word "Engineer", the words "in writing" are added.

## **52.1 Valuation of Variations**

In the tenth line, after the words "Engineer shall" the following is added:  
within a period not exceeding one-eighth of the completion time subject to a minimum of 56 days from the date of disagreement whichever is later.

## **53.4 Failure to Comply**

This Sub-Clause is deleted in its entirety.

## **54.5 Conditions of Hire of Contractor's Equipment**

The following paragraph is added:

The Contractor shall, upon request by the Engineer at any time in relation to any item of hired Contractor's Equipment, forthwith notify the Engineer in writing the name and address of the Owner of the equipment and shall certify that the agreement for the hire thereof contains a provision in accordance with the requirements set forth above.

The following Sub-Clauses 59.4 & 59.5 are added:

## **59.4 Payments to Nominated Subcontractors**

The Contractor shall pay to the nominated Subcontractor the amounts which the Engineer certifies to be due in accordance with the subcontract. These amounts plus other charges shall be included in the Contract Price in accordance with Clause 58 [Provisional Sums], except as stated in Sub-Clause 59.5 [Certification of Payments].

## **59.5 Certification of Payments & Nominated Subcontractors**

Before issuing a Payment Certificate which includes an amount payable to a nominated Subcontractor, the Engineer may request the Contractor to supply reasonable evidence that the nominated Subcontractor has received all amounts due in accordance with previous Payment Certificates, less applicable deductions for retention or otherwise. Unless the Contractor:

- a) submits reasonable evidence to the Engineer, or
- b)
  - i) satisfies the Engineer in writing that the Contractor is reasonably entitled to withhold or refuse to pay these amounts, and
  - ii) submits to the Engineer reasonable evidence that the nominated Subcontractor has been notified of the Contractor's entitlement,

then the Procuring Agency may (at his sole discretion) pay direct to the nominated Subcontractor, part or all of such amounts previously certified (less applicable deductions) as are due to the nominated Subcontractor and for which the Contractor has failed to submit the evidence described in sub-paragraphs (a) or (b) above. The Contractor shall then repay, to the Procuring Agency, the amount which the nominated Subcontractor was directly paid by the Procuring Agency.

## 60.1 Monthly Statements

In the first line after the word “shall”, the following is added:

“on the basis of the joint measurement of work done under Clause 56.1,”

In Para (c) the words “the Appendix to Tender” are deleted and substituted with the words “ Sub-Clause 60.11 (a)(6) hereof”.

(in case Clause 60.11 is applicable)

## 60.2 Monthly Payments

In the first line, “28” is substituted by “14”.

### 60.11 Secured Advance on Materials

- a) The Contractor shall be entitled to receive from the Procuring Agency Secured Advance against an indemnity bond acceptable to the Procuring Agency of such sum as the Engineer may consider proper in respect of non-perishable materials brought at the Site but not yet incorporated in the Permanent Works provided that:
- (1) The materials are in accordance with the Specifications for the Permanent Works;
  - (2) Such materials have been delivered to the Site and are properly stored and protected against loss or damage or deterioration to the satisfaction of the Engineer but at the risk and cost of the Contractor;
  - (3) The Contractor's records of the requirements, orders, receipts and use of materials are kept in a form approved by the Engineer, and such records shall be available for inspection by the Engineer;
  - (4) The Contractor shall submit with his monthly statement the estimated value of the materials on Site together with such documents as may be required by the Engineer for the purpose of valuation of materials and providing evidence of ownership and payment therefor;
  - (5) Ownership of such materials shall be deemed to vest in the Procuring Agency and these materials shall not be removed from the Site or otherwise disposed of without written permission of the Procuring Agency; and
  - (6) The sum payable for such materials on Site shall not exceed 75 % of the (i) landed cost of imported materials, or (ii) ex-factory / ex-warehouse price of locally manufactured or produced materials, or (iii) market price of other materials.
- (b) The recovery of Secured Advance paid to the Contractor under the above provisions shall be effected from the monthly payments on actual consumption basis.

## 60.11 Financial Assistance to Contractor

Financial assistance shall be made available to the Contractor by the Procuring Agency by adopting any one of the following three Alternatives:

(Appropriate alternative only to be retained)

### Alternative One: Mobilization Advance

- (a) An interest-free Mobilization Advance up to 15 % of the Contract Price stated in the Letter of Acceptance shall be paid by the Procuring Agency to the Contractor in two equal parts upon submission by the Contractor of a Mobilization Advance Guarantee/Bond for the full amount of the Advance in the specified form from a Scheduled Bank in Pakistan or an insurance company acceptable to the Procuring Agency:
- (1) First part within 14 days after signing the Contract Agreement or date of receipt of Engineer's Notice to commence, whichever is earlier; and
  - (2) Second part within 42 days from the date of payment of the first part, subject to the satisfaction of the Engineer as to the state of mobilization of the Contractor.
- (b) This Advance shall be recovered in equal instalments; first instalment at the expiry of third month after the date of payment of first part of Advance and the last instalment 12 months before the date of completion of the Works as per Clause 43 hereof.

### Alternative Two: Mobilization/ Demobilization Cost

Mobilization Cost shall be paid to the Contractor as a part of the Billed Bill of Quantities. This cost shall not exceed 10 % of the Tender Price and shall be paid to the Contractor as follows:

- (i) 80 % of the Mobilization Cost shall be paid for mobilization at Site. This payment shall be in three stages as follows:
- Stage I: 20 % of Mobilization Cost upon obtaining and furnishing of Performance Security and insurance policies and construction of camp and housing facilities as required under the Contract;
- Stage II: 30 % of Mobilization Cost upon providing & installing preliminary requirements of Contractor's Equipment, materials and temporary structures for the commencement of Works to the satisfaction of the Engineer and achieving 3 % value of the Works (excluding payment under Stage-I);
- Stage III: 30 % of Mobilization Cost upon providing balance Contractor's Equipment to complete full requirement for the entire work and after achievement of progress to the extent of 6 % value of the Works (excluding payments under Stages I and II); and
- (ii) 20 % of Mobilization Cost shall be paid for operation and maintenance of the constructed facilities and for demobilization as per schedule of payment to be submitted by the Contractor in accordance with Clause 57.2 and approved by the Engineer.

### Alternative Three: Materials Supplied by Procuring Agency

The Procuring Agency shall supply to the Contractor materials, like cement, steel, bitumen or any other material whichever deemed necessary to complete the project; and the cost thereof shall be recovered from the Contractor through monthly statements on the basis of actual consumption.

The list of materials, quantities and rates to be charged to the Contractor shall be provided alongwith Appendix-A to Bid "Special Stipulations".  
(Procuring Agency may opt either "Secured Advance on Materials" or "Financial Assistance to Contractor")

### **63.1 Default of Contractor**

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

Provided further that in addition to the action taken by the Procuring Agency against the Contractor under this Clause, the Procuring Agency may also refer the case of default of the Contractor to Pakistan Engineering Council for punitive action under the Construction and Operation of Engineering Works Bye-Laws 1987, as amended from time to time.

### **65.2 Special Risks**

The text is deleted and substituted with the following:

The Special Risks are the risks defined under Sub-Clause 20.4 sub paragraphs (a) (i) to (a) (v).

### **67.3 Arbitration**

In the sixth to eight lines, the words "shall be finally settled ..... appointed under such Rules" are deleted and substituted with the following:

shall be finally settled under the provisions of the Arbitration Act, 1940 as amended or any statutory modification or re-enactment thereof for the time being in force.

The following paragraph is added:

The place of arbitration shall be Karachi Pakistan.

### **68.1 Notice to Contractor**

The following paragraph is added:

For the purposes of this Sub-Clause, the Contractor shall, immediately after receipt of Letter of Acceptance, intimate in writing to the Procuring Agency and the Engineer by registered post, the address of his principal place of business or any change in such address during the period of the Contract.

### **68.2 Notice to Procuring Agency and Engineer**

For the purposes of this Sub-Clause, the respective address are:

- a) The Procuring Agency :  
**Sindh Madressatul Islam University, Aiwan-e-Tijarat Road, Karachi**



- b) The Engineer:  
**EA Consulting Pvt. Ltd., AL-9, 15<sup>th</sup> Lane, Khayaban-e-Hilal, Phase-VII, DHA, Karachi**

### **73.1 Payment of Income Tax**

The Contractor, Subcontractors and their employees shall be responsible for payment of all their income tax, super tax, tax on services, GST and other taxes on income arising out of the Contract and the rates and prices stated in the Contract shall be deemed to cover all such taxes. All prices are inclusive income tax, sales tax, tax on services and other taxes.

### **73.2 Customs Duty & Taxes**

(Procuring Agency may incorporate provisions where applicable)

### **74.1 Integrity Pact**

If the Contractor or any of his Subcontractors, agents or servants is found to have violated or involved in violation of the Integrity Pact signed by the Contractor as Appendix-L to his Bid, then the Procuring Agency 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, agents or servants;
- (b) terminate the Contract; and
- (c) recover from the Contractor any loss or damage to the Procuring Agency as a result of such termination or of any other corrupt business practices of the Contractor or any of his Subcontractors, agents or servants.

The termination under Sub-Para (b) of this Sub-Clause shall proceed in the manner prescribed under Sub-Clauses 63.1 to 63.4 and the payment under Sub-Clause 63.3 shall be made after having deducted the amounts due to the Procuring Agency under Sub-Para (a) and (c) of this Sub-Clause.

### **75.1 Termination of Contract for Procuring Agency's Convenience**

The Procuring Agency shall be entitled to terminate the Contract at any time for the Procuring Agency's convenience after giving 56 days prior notice to the Contractor, with a copy to the Engineer. In the event of such termination, the Contractor:

- (a) shall proceed as provided in Sub-Clause 65.7 hereof; and
- (b) shall be paid by the Procuring Agency as provided in Sub-Clause 65.8 hereof.

### **76.1 Liability of Contractor**

The Contractor or his Subcontractors or assigns shall follow strictly, all relevant labour laws including the Workmen's Compensation Act and the Procuring Agency shall be fully indemnified for all claims, damages etc. arising out of any dispute between the Contractor, his Subcontractors or assigns and the labour employed by them.

### **77.1 Joint and Several Liability**

If the Contractor is a joint venture of two or more persons, all such persons shall be jointly and severally bound to the Procuring Agency for the fulfilment of the terms of the Contract and shall designate one of such persons to act as leader with authority to bind the joint venture. The composition or the constitution of the joint venture shall not be altered without the prior consent of the Procuring Agency.

### **78.1 Details to be Confidential**

The Contractor shall treat the details of the Contract as private and confidential, save in so far as may be necessary for the purposes thereof, and shall not publish or disclose the same or any particulars thereof in any trade or technical paper or elsewhere without the prior consent in writing of the Procuring Agency or the Engineer. If any dispute arises as to the necessity of any publication or disclosure for the purpose of the Contract, the same shall be referred to the decision of the Engineer whose award shall be final.

# **SPECIFICATIONS - SPECIAL PROVISION**

## **1. DESCRIPTION OF PROJECT**

### **1.1 GENERAL**

The employer intends to Develop SMIU Model School & University Academic Block at SMIU City Campus, Karachi.

## **2. THE SITE**

Site of Works is the area for construction lying within the line of boundaries and limits shown on the Drawings and any such additional areas adjacent thereto as may be designated by the Engineer from time to time for the construction to be performed under the contract and all such areas and additional areas shall be comprised in the site defined in clause 1 Conditions of Contract.

The Employer will give to the contractor possession of the area designated and defined as the site and shown on the drawings as may be required to implement as much of the works when the Engineer' Notice to Commence the Work is given.

## **3. WORK UNDER THE CONTRACT**

### **3.1 General Description**

The contract comprises the execution and completion of the works, remedying of any defects therein maintenance of utility services and the provisions of all labor, materials equipment plant and everything whether of a temporary or permanent nature required in the such execution, completion, remedying and maintenance so far as the necessity for providing the same is specified or can reasonably be inferred from the Contract.

## **4. GENERAL RULES OF SPECIFICATIONS**

### **a) Specification or as specified**

Specification or as specified refers to the specifications outlined in these Documents and where no specifications are available for any work or where the same are found not applicable then the relevant applicable ASTM or BSS specifications or equivalent standards shall apply in the same order.

Any time for which no specifications are outlined but which are identified in drawings shall be completed accordingly to the standards as per ASTM/BSS these include items that may be added in the future. The Employer/ Employer's representative may supplement such specifications during the progress of work. All materials and processes used for these items shall be subject to standard testing and if found below the pertinent ASTM/BSS standards, shall be removed from the site immediately at the contractor's expense.

**b) Standards and codes**

Wherever reference is made in the specifications to the respective standards codes in accordance to the which goods and materials are to be furnished and work is to be performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly set forth in the contract.

**c) Material and process**

All goods and materials to be incorporated in the works shall be new, unused of the most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the contract.

**d) Equivalent Material, Process etc.**

Where specific materials, processes etc. are specified and the same are not available other alternative material and processes which ensure an equal or higher quality than those specified will be accepted subject to the Employer prior review and written approval. Differences between the specified and the proposed alternatives must be fully described in writing by the contractor and submitted to the Employer's approval who may give such approval after determining that the alternative proposed ensures equal or higher quality.

**e) Approved, Directed Instructed**

Approved, directed, instructed means the approval etc. of the Employer unless otherwise stated.

**f) Alternatives**

Where alternative materials process etc., are specified the selection will depend on local conditions and discretion rest with the Employer/ Employer's Representative whose decision shall be final and binding.

**g) Catalogues/Standards/Manufacturer's Instructions, etc.**

Wherever the manufacturer's/supplier's instructions. Manuals guarantees and ASTM/BSS standards are referred to the in the specifications and details of BOQ; all such literature shall be submitted by the contractor to the Employer/ Employer's Representative for due checking, approval and record.

**h) Applicability**

Unless stated or specified else-where to the contrary these General Rules shall apply to all sections of work irrespective of their sequences, location and description.

## **5. DRAWINGS**

### **5.1 Tender Drawings**

Tender Drawings issued with the Tender Documents called Tender Drawings; show scope of the work to be performed by the contractor. The Drawings are generally in sufficient details so as to be used as a basis for construction, fabrication and for placing under Sub-Clause 5.2 hereof.

### **5.2 Construction Drawings, Supplementary Drawings**

After award of Contract, the Engineer will issue Construction Drawings to the Contractors.

The Engineer shall have authority to issue the Contractor, from time to time, such supplementary Drawings and instructions as shall be necessary for the purpose of the proper and adequate execution and completion of the Works and the remedying of any defect therein. The Contractor shall follow these drawings.

The Contractor shall give notice to the Engineer regarding the part of the Drawings which is in his opinion contains discrepancies or are not clear. The Engineer shall issue necessary clarification or supplementary Drawing in greater details as required to execute the works. These supplementary Drawings shall be reviewed by the Engineer for his determination of adjustment of the Contract Price under Clause 51 and 52 of Conditions of Contract.

### **5.3 Definition of Term Drawings**

The term used in the specifications means the Drawings referred in Clause 5.1 and 5.2 hereof.

### **5.4 Checking of Drawings**

The contractor shall check all drawings carefully as soon as practicable after receipt thereof, and shall promptly notify the Engineer of any errors discovered.

### **5.5 Copies of Drawings**

Drawings will be issued to the contractor as described below.

### **5.6 Tender Drawings**

One (1) set of the Tender Drawings will be issued to the Contractor along with Tender Document. Additional sets will be provided at cost of reproduction upon written request of the contractor.

## **5.7 Construction Drawings/ Supplementary Drawings**

One (1) print of each Construction Drawings/ Supplementary drawings will be issued to the contractor free of charge. Additional sets will be provided at cost of reproduction upon written request of the Contractor.

## **5.8 Drawings to be furnished by the Contractor/As-Built Drawings**

The contractor shall submit to the Engineer for review of such drawings as required under the contract sufficient in advance of the work intended to be executed.

The contractor shall, at all times, keep on site a separate set of prints on which all significant changes between the work shown on the drawings and the which is actually constructed, shall be noted neatly, accurately and promptly as the work progresses. The Sub-contractor(s) for plumbing, mechanical and electrical shall at all times, keep in site, a separate set of prints of the drawings (showing their parts of the Works) on which all significant changes between the work shown on the Drawings and that which is actually constructed, shall be noted neatly, accurately and promptly as the work progress. Such drawings shall show the exact physical location and configuration of the works as actually installed.

The contractor shall within fourteen (14) days of issuance Taking-Over Certificate for whole of the Works furnished to the Engineer for his approval two (2) copies of such marked up drawings. One (1) copy of each of the marked up drawings approved by the engineer shall be returned to the contractor by the Engineer and these shall be used for the preparation of the AS-BULIT Drawings.

The contractor shall furnish to the Engineer Six (6) Complete Sets of all AS-BUILT Drawings as well as AutoCAD soft copy within 30 Days of receipt of drawings stated above, from the Engineer.

## **6 NOT USED**

## **7. APPROVAL OF MATERIALS AND PLANT**

### **7.1 Quantity of Materials**

All materials, fixtures, fittings supplies and plant furnished under the contract shall be new and unused, standard first grade quality and of the best workmanship and design. No inferior or low-grade materials, supplies or articles will be either approved or accepted and all work of assembly and construction shall be done in a first class and workmanlike manner. In asking for prices for materials intended for delivery to the site and incorporation in the Works under any portion of these specifications the contractor shall provide the manufacturer or supplier with complete information as may be necessary to secure compliance to this Clause and in every case, he shall quote this Clause in full to each manufacturer or Supplier.

## **7.2 Submission of Samples and Data.**

As soon as practicable after the award of Contract, the Contractor shall submit for the approval if the Engineer drawings, Catalogues diagrams and other descriptive data for all mechanical, electrical, architectural and such other materials and plant designated by the Engineer, which the contractor proposes for use under this Contract. For certain materials and plant, data may be required to be submitted in accordance with a detail form furnished by the Engineer. Samples of materials (2 Sets) shall be submitted by the Contractor to the Engineer at Contractor's Cost for approval sufficiently in advance of the materials intended to be incorporated in the Works.

## **7.3 Testing**

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

The quality control testing shall be performed by the contractor's competent personnel in accordance with a site testing as approved by the Engineer.

The contractor shall keep a complete record of all quality tests programme performed on site.

## **7.4 Testing Laboratory Certificates.**

The Engineer may accept a certificate from a commercial testing laboratory, satisfactory to him, certifying that the product has been tested within a period acceptable to the Engineer and that it conforms to the requirements of these Specifications.

## **7.5 Inspection**

All materials and Plant furnished and all work performed under this contract will be subject to inspection by the Engineer at all times and in all states of completion both off-site and on-site. The contractor shall furnish promptly without additional charge, all facilitate, and labor and materials reasonably needed for performing such inspection and testing as may be required by the Engineer.

## **7.6 Approved Sample at Site.**

The contractor shall at all times keep on the site approved samples. All such samples shall be made available to the Engineer as and when required.

## **7.7 Site laboratory.**

The contractor shall establish a Site Laboratory for the purpose for necessary testing. The laboratory equipped shall remain the contractors property at all times.



## **8. CONSTRUCTION SCHEDULE**

### **8.1 Submittal Date**

The programme of works submitted by the Contractor in accordance with Clause 14 Programme to be submitted in the form of a detailed schedule based on a computerized network analysis covering all construction activities indicating critical activities with critical path resource scheduling for contractor's equipment material and labor within the period stated in the Appendix A to Tender. All the milestones shall be clearly identified.

### **8.2 Requirements**

The detailed submittal shall consist of schedule, network analysis tabulations and narrative descriptions of the proposed construction programme.

Each summary or detailed schedule shall consist of a bar chart and time scaled network. The schedule start and finish times for all activities on the bar charts shall agree with those in the network. All inter-relationships and inter-dependencies between structures shall be clearly indicated on the schedules.

The network shall show the order and interdependences of activities planned by the contractor and shall be time – scaled accordingly to calendar dates.

### **8.3 Monthly Reports.**

Each month the Contractor shall submit a report consisting of:

- Copies of the bar charts for the current phase with both actual progress and scheduled progress shown.
- Network analysis tabulations as in Sub-Clause 8.3 above, reflecting actual start date and finish dates where applicable.
- A narrative report discussing any significant deviations from the schedule and, if necessary explaining the steps proposed to be taken to maintain the approved schedule.

## **9. SITE OFFICE AND TEMPORARY FACILITIES TO BE PROVIDED BY THE CONTRACTOR**

### **9.1 Notice Board**

The Contractor shall erect and maintain at the site in location to be approved by the Engineer 3 Sign Boards 8' x 6' for painting the name of Work name of client, name of Consultants, name of Contractor and Project Cost on Both side. The notice board shall comprise of the following;

Frame of 3" dia GI pipe properly painted as per direction of the Engineer.

2 Nos. Posts of 3" Dia GI Pipe 4' above ground and 4' below ground embedded in 1:2:4 cc 2'x2'x4' with proper arrangement of anchorage and brasses.

5 Nos. MS/ Polyvinyl sheets 9" wide and 1 No. 12" wide, 8' long each fixed with the pipe frame with 3" gap between each strip.

Background painted in white with synthetic enamel paint on both sides.

Alphabets of appropriate size as approve by the Engineer in reflective paint.

## **11 SAFETY**

### **11.1 Accident prevention, protective equipment.**

The contractor shall comply and enforce compliance by all his sub-contractors with the highest standards of safety and accident prevention and compliance with all applicable laws, ordinance and statutory provisions.

Where overhead work is being carried out warning signs shall be installed at ground level clearly warning of the overhead work.

All warning signs shall be in two languages, English and Urdu, and shall at all times be maintained in a cleaned and legible condition, to the satisfaction of the Engineer.

Trash shall be removed at frequent intervals to the satisfaction of the Engineer.

## **12. PAYMENTS FOR WORK REQUIRED BY SPECIAL PROVISIONS**

Unless otherwise specifically stated in the Contract, the price of all work required by the Special Provision shall be deemed considered to be included in the contract price.

13. Materials obtained from excavation will be the property of the employer. Serviceable materials are to be stacked in places pointed out by the Engineer-in-charge. The Contractor undertakes to have the site clean and free from rubbish to the satisfaction of the Engineer. All surplus materials, rubbish etc; will be removed to places to be fixed by the Engineer and nothing extra will be paid for this.
14. On completion of the work or earlier as directed by the Engineer, the Contractor shall remove all temporary structure (Godowns, site offices, etc.) erected by him at the site of work. He shall fill tanks dug out by him at site, remove all debris and other materials like surplus sand, stone ballast, rubbish etc.; and in short, shall leave the site in a neat and tidy condition.
15. The Contractors in the course of their work should understand that all materials (e.g. , stone and other materials) obtained in the work or dismantling, excavation, etc., will be considered as Employer's property and issued to the contractor (if they require the same for their own use) at rates approved by the Engineer. If the materials are not required by them they will be disposed of in the interest of the Employer.
17. The Contractor shall inspect the site of works and acquaint himself with the nature and requirements of the work, facilities of access for materials, removal of rubbish, cost of carriage, nature of strata, etc., before submitting the Bid.
18. The Contractor shall have to make proper arrangements for road crossing barriers during work hours in the day time as well as in the night when danger lights will have be provided on either ends at his own cost and no extra cost will be paid. Sufficient barricades and red lights will be provided by the Contractor where required to avoid the chances of accidents. In case an accident occurs for failure on the part of the contractor, he shall be entirely responsible for the consequences.
19. No material shall be removed from the site without the written permission of the Engineer.

20. Dewatering including shoring wherever so required for any foundation area, pumping, bailing out water, drainage of water within plot areas if any shall be deemed to have been included in the rates quoted by the tenderers and no extra payment will be made.
21. The contractor shall execute all works so their own cost for diversion of water away from the plot as per site requirements to have full satisfaction of Engineer in charge and no additional payment will be made on this account.
22. The Engineer reserves the right to select all materials and the type, grade, heating, capacity and quantity of proportion of any or all materials as required for a particular work. The decision of Engineer in this respect shall be final and binding on the contractor. The rejects on the materials must be carted at his own cost. If the rejected materials are not removed in within one month of its rejection the materials will become the property of the Employer or will be removed at the contractors cost.

### **23. Attendance of Meetings**

The contractor shall attend and cause his sub-contractors to attend any or all meetings when called by the Employer or the Engineer or his representative to discuss progress of the work and other matters related to the work and the Contract, without any compensation from the Employer.

The contractor shall bear all expenses of the Employer and his agents and representatives and the Engineer, his agents and representative if requested by the contractor for any meetings, instructions and approvals away from the site.

The proceedings of the Meetings shall be recorded by the Engineer which shall form part of the Contract.

### **24. Document not to be altered or mutilated.**

No alteration or mutilation shall be made in the form of bid or in any of the documents attached to it. Any comments which it is desired to make shall not be placed on any of the documents attached hereto, but shall not be placed on any of the documents, but shall take the form of separate statement shall be as brief as possible and referenced to items, clauses and pages of the annexed documents.

### **25. First Aid Facilities**

The Contractor shall provide and maintain adequate First Aid Facilities at all times, convenient to the site approval of the Employer.

### **26. Report in Progress of Work and Photographs**

The contractor shall during the execution of the work, submit to the Employer (3 Copies) and Engineer (2 Copies) so as to reach them in the first week of every calendar month, a report on the actual progress if the works attained by him during the preceding month fully supported with color photographs of acceptable sizes depicting the complete stages of the works. The submitted photographs shall clearly show the date and year on the lower bottom of photographs.

**FACULTY BLOCK OF**  
**NATURAL SCIENCES**

S.No	Description	Amount
A	PRELIMINARIES & GENERAL REQUIREMENTS	<i>Included in Permanent works</i>
B	PERMENANT Works	
1	CIVIL WORKS	
2	ELECTRICAL WORKS	
3	ELV WORKS	
4	PLUMBING WORKS	
5	HVAC WORKS	
<b>TOTAL COST</b>		

# **CIVIL WORK**

## BILL OF QUANTITIES

S.No	Description	Amount
<b>A</b>	<b>SCHEDULE ITEM</b>	
1	EARTH WORKS	1,660,680
2	SUB STRUCTURE	29,035,125
3	SUPER STRUCTURE	48,046,641
4	MASONRY WORKS	11,535,088
5	THERMAL & MOISTURE PROTECTION	864,630
6	METAL WORKS	5,845,788
7	WOOD WORKS	3,534,266
8	FLOOR FINISHES	8,534,945
9	WALL FINISHES	10,339,387
10	CEILING FINISHES	2,540,911
11	EXTERNAL FINISHES (BUILDING)	4,309,052
12	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	1,769,668
	<b>Total of Schedule Items - A</b> _____ % Above/below on Civil Works of PWD-2012	<b>128,016,181</b>
	<b>Total of Schedule Items - A</b>	
<b>B</b>	<b>NON-SCHEDULE ITEM</b>	
1	EARTH WORKS	
2	SUB STRUCTURE	
3	SUPER STRUCTURE	
4	MASONRY WORKS	
5	THERMAL & MOISTURE PROTECTION	
6	METAL WORKS	
7	WOOD WORKS	
8	FLOOR FINISHES	
9	WALL FINISHES	
10	CEILING FINISHES	
11	EXTERNAL FINISHES (BUILDING)	
12	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	
	<b>Total of Non-Schedule Items - B</b>	
	<b>TOTAL CARRIED TO GRAND SUMMARY (A+B)</b>	

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
<b>SCHEDULE ITEMS</b>						
1		<b><u>EARTH WORKS</u></b>				
1.1	Code -103,	Excavation for foundations trenches, drains, underground tanks and septic tanks in <b>gravelly soil</b> (medium dense to very dense fine to coarse grained sandy gravel) and back filling the excavated material in foundation, plinth or under floor including breaking clods, watering, consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction, dressing and disposal of surplus excavated stuff as directed, lead up to one chain (30.5 R.m) and lift up to 5 feet (1.52 m) etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 2	From ± 0'-0" to -5' - 0"	66361 Cft	100 Cft	613.14	406,886
	Item # 2+28	From -5' - 0" to -8' - 0"	2687 Cft	100 Cft	690.49	18,553
	Item # 2+28+28	From -8' - 0" to -11' - 0"	1120 Cft	100 Cft	767.84	8,600
1.2	Code -104 Item #8	Supplying earth from approved outside sources within a radius of 5 miles (8 km) including digging, loading and unloading and filling in foundations trenches plinth or under floor, etc. including breaking clods, dressing, watering and consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction complete within a lead of one chain (30.5 R.m) and lift of 5 feet (1.52mm) etc. complete, including all lifts etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	29968 Cft	100 Cft	2,467.50	739,460
1.3	Code -117 Item #1	Providing and laying soling stones 6 inches to 9 inches (152 mm to 229 mm) size under floors/foundations & where required etc. including packing with sprawls and chips and consolidating etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	14984 Cft	100 Cft	3,251.34	487,181
<b>Total Carried to Summary</b>						<b>1,660,680</b>



S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2		<b>SUB STRUCTURE</b> <i>Note: All RCC Concrete will be used only Ready mixed.</i>				
2.1	Code -106	<b>CONCRETE WORKS</b> Providing and laying in situ <b>1:4:8</b> (1 cement 4 sand and 8 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
2.2	Item # 11 Code -106	Below plinth beam,situ,walls,tanks, over stone soling or where required <b>(Cylindrical 1000 Psi)</b>	11824 Cft	100 Cft	14,411.43	1,704,007
2.3	Item # 12 Code -114	Providing and laying in situ <b>1:3:6</b> (1 cement 3 sand and 6 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work, etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.  For Cast in situ / mass concrete or where required <b>(Cylindrical 1500 Psi)</b>	687 Cft	100 Cft	15,840.97	108,827
	Item # 1+136	<b>REINFORCED CONCRETE WORKS</b> Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N/mm <sup>2</sup> at 28 days) with a mix not leaner than 1:2:4 in columns footing of required shape with columns and pillars, of any shape including form work and its removal, compacting, leveling and curing etc. complete but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.  Foundation for any type <b>(Cylindrical Strength 2500 Psi)</b>	48467 Cft	100 Cft	17,514.88	8,488,937
<b>Total Carried to Collection</b>						<b>10,301,771</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>4500 lbs. per sq. inch</b> (31.04 N/mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:1:2</b> in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth. etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 4+135+138	Columns upto plinth <b>(Cylindrical Strength 4000 Psi)</b>	1997 Cft	100 Cft	26,704.50	533,289
2.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>4500 lbs. per sq. inch</b> (31.04 N/mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:1:2</b> in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 9+135+138	RCC Wall/Shear Wall upto plinth <b>(Cylindrical Strength 4000 Psi)</b>	78 Cft	100 Cft	27,958.39	21,808
2.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in plinth beams of required shape and design including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 8+136	Plinth Beams i/c nibs / projections <b>(Cylindrical Strength 2500 Psi)</b>	5222 Cft	100 Cft	18,172.93	948,990
<b>Total Carried to Collection</b>						<b>1,504,087</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in foundation or bottom slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 99+136	UGWTank Bottom Slab <b>(Cylindrical Strength 2500 Psi)</b>	628 Cft	100 Cft	15,182.84	95,348
2.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in top slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 104+136	UGWTank Top Slab <b>(Cylindrical Strength 2500 Psi)</b>	157 Cft	100 Cft	20,471.59	32,140
2.9	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in walls of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 101+136	UGWTank Walls <b>(Cylindrical Strength 2500 Psi)</b>	349 Cft	100 Cft	20,782.39	72,531
<b>Total Carried to Collection</b>						<b>200,019</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.10	Code -114 Item # 166	Providing and laying hard grade ribbed deformed <b>(minimum yield point 60,000 psi or 414 Mpa)</b> reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <b>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</b>	135730 Kg	Kg	123.02	16,697,505
2.11	Code -124 Item # 93	Providing and fixing plain polyvinyl chloride (PVC) water stops 12" (305 mm) wide in vertical or horizontal expansion joints including cutting and jointing complete in all floors etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	111 Rft	Rft	500.16	55,518
2.12	Code -108 Item # 12	Providing a coat of <b>bitumen emulsion at 10 Lbs. per % sft. (0.49 Kg/sm)</b> on walls and floor in ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	42622 Sft	100 Sft	648.08	276,225
<b>Total Carried to Collection</b>						<b>17,029,248</b>
<b>COLLECTION</b>						
		Page No -2				10,301,771
		Page No -3				1,504,087
		Page No -4				200,019
		Total from this Page				17,029,248
<b>Total Carried to Summary</b>						<b>29,035,125</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
<b>NON-SCHEDULE ITEMS</b>						
<b><u>SUB STRUCTURE</u></b>						
<b><u>TERMITE PROOFING</u></b>						
2.13		<p>Termite control treatment of sub grade soil, excavated surfaces and fill material with HEPTACHLOR emulsifiable to 0.5% with clean water or AGENDA 25 EC containing FIPRONIL or BIFLEX with Bifenthrin or DURSBIN or TENEKIL PLUS or MIRAGE ALI AKBER GROUP or approved equivalent as per manufacturer's specifications and instructions. etc., complete in all respects as per drawing, standard , specifications and as directed by the Engineer.</p> <p><b>(Note: Plinth Area will be measured one time for payment where is the number of applications will be three times on all horizontal &amp; vertical surfaces of the excavation for termite proofing)</b></p>	26056 Sft	Sft		
<b>Total Carried to Summary</b>						

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
<b>3</b>		<b>SUPER STRUCTURE</b> <b>Note: All RCC Concrete will be used only Ready mixed.</b>				
3.1	Code -114 Item # 4+135+138	<b>REINFORCED CONCRETE WORKS</b> Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>4500 lbs. per sq. inch</b> (31.04 N/mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:1:2</b> in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in the ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
		Columns <b>(Cylindrical Strength 4000 Psi)</b>				
	Item # 24+135+138	Ground Floor	6441 Cft	100 Cft	30,389.36	1,957,379
	Item # 24+135+138+92	First Floor	4477 Cft	100 Cft	31,338.56	1,403,027
	Item # 24+135+138+ 92+93	Second Floor	4375 Cft	100 Cft	32,090.01	1,403,938
	Item # 24+135+138+ 92+93+93	Roof	461 Cft	100 Cft	32,841.46	151,399
3.2	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>4500 lbs. per sq. inch</b> (31.04 N/mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:1:2</b> in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
		RCC Wall / Shear Wall <b>(Cylindrical Strength 4000 Psi)</b>				
	Item # 30+135+138	Ground Floor	364 Cft	100 Cft	28,692.59	104,441
	Item # 30+135+138+92	First Floor	395 Cft	100 Cft	29,641.79	117,085
	Item # 30+135+138+ 92+93	Second Floor	395 Cft	100 Cft	30,393.24	120,053
<b>Total Carried to Collection</b>						<b>5,257,322</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.3	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in straight beams lintels cantilever beams of required shape or section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.  Beams /Arches/ purdi / bracing / lintels / nibs / sills / coping / parapet wall /bands/around opening and projections <b>(Cylindrical Strength 2500 Psi)</b>				
	Item # 38+136	Ground Floor	3699 Cft	100 Cft	20,668.60	764,532
	Item # 38+136+92	First Floor	5651 Cft	100 Cft	21,617.80	1,221,622
	Item # 38+136+92+93	Second Floor	4880 Cft	100 Cft	22,369.25	1,091,619
	Item # 38+136+92+93+93	Roof	353 Cft	100 Cft	23,120.70	81,616
3.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in ordinary slab more than 6 inches (152 mm) thick including form work and its removal compacting and curing etc. complete but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.  Slab i/c projections <b>(Cylindrical Strength 2500 Psi)</b>				
	Item # 57+136	Ground Floor	11245 Cft	100 Cft	19,520.67	2,195,099
	Item # 57+136+92	First Floor	12368 Cft	100 Cft	20,469.87	2,531,714
	Item # 57+136+92+93	Second Floor	11043 Cft	100 Cft	21,221.32	2,343,470
	Item # 57+136+92+93+93	Roof	1023 Cft	100 Cft	21,972.77	224,781
<b>Total Carried to Collection</b>						<b>10,454,453</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in straight stairs and landing of required section including form work and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in basement plinth and ground floor.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.  Stair Case / steps /seats (Steps, Landing & Waist slab) <b>(Cylindrical Strength 2500 Psi)</b>				
	Item # 50+136	Ground Floor	2382 Cft	100 Cft	25,989.63	619,073
	Item # 50+136+92	First Floor	737 Cft	100 Cft	26,938.83	198,539
	Item # 50+136+92+93	Second Floor	190 Cft	100 Cft	27,690.28	52,612
3.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in a square of rectangular bottom slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement .etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 114+136+(127x2),	OH Water Tank Bottom Slab <b>(Cylindrical Strength 2500 Psi)</b>	149 Cft	100 Cft	26,609.81	39,649
3.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in straight walls in over head water tank bins, bunkers, intze tanks and silo up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 112+136+(127x2),	OH Water Tank Walls <b>(Cylindrical Strength 2500 Psi)</b>	268 Cft	100 Cft	27,185.58	72,857
<b>Total Carried to Collection</b>						<b>982,730</b>



S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in roof slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
3.9	Item # 118+136+(127x2), Code -114	OH Water Tank Top Slab <b>(Cylindrical Strength 2500 Psi)</b> Providing and laying hard grade ribbed deformed <b>(minimum yield point 60,000 psi or 414 Mpa)</b> reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <b>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</b>	104 Cft	100 Cft	24,213.37	25,182
	Item # 166	Ground Floor	88466 Kg	Kg	123.02	10,883,087
	Item # 166+174	First Floor	82046 Kg	Kg	124.47	10,212,266
	Item # 166+174+175	Second Floor	73018 Kg	Kg	125.92	9,194,427
	Item # 166+174+175 +175	Roof	8143 Kg	Kg	127.37	1,037,174
<b>Total Carried to Collection</b>						<b>31,352,136</b>
<b>COLLECTION</b>						
		Page No -7				5,257,322
		Page No -8				10,454,453
		Page No -9				982,730
		Total from this Page				31,352,136
<b>Total Carried to Summary</b>						<b>48,046,641</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
<b>A - SCHEDULE ITEMS</b>						
<b>4</b>		<b>DPC &amp; MASONRY WORKS</b>				
		<b>Damp Proof Course (DPC)</b>				
4.1	Item # 3 Code -108 Page # 47	Providing and laying 2 inches (51 mm) thick damp proof course with cement concrete 1:2:4 cast in situ using graded screened bajri of 3/4 inch (19 mm) and down gauge mixed with any approved water proofing agent including compacting, curing form work and its removal etc. complete, but excluding the cost of water proofing agent .etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. 2" thick DPC	1826 Sft.	100 Sft	2,659.79	48,568
4.2	Item # 5 Code -108 Page # 47	Extra for using water proofing agent pudlo in item Nos. 4.1 (quantity to be used as per manufacturer's specification/2.50Kg per 100Sft).etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	48 Kg	Kg	86.10	4,133
		<b>Block Masonry (Hollow &amp; Solids)</b>				
4.3	Code-111 Page # 87 & 82	Providing and laying 1:3:6 cement concrete <b>hollow block masonry</b> of any thickness using graded screened bajri 1/2 inch (13 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking, out Joints and curing etc. complete in basement and ground floor superstructure.				
	Item # 1+12+18+19	Ground Floor	7942 Cft	100 Cft	13,779.44	1,094,363
	Item # 1+9+12+18+19	First Floor	7794 Cft	100 Cft	14,338.43	1,117,537
	Item # 1+9+10+12+18+19	Second Floor	7583 Cft	100 Cft	14,722.11	1,116,378
	Item # 1+9+10+10+12+ 18+19	Roof	4263 Cft	100 Cft	15,105.79	643,960
4.4	Code-110 Page # 77, 80, 81 & 82	Providing and laying 1:3:6 machine made standard size 4"x8"x12" & 6"x8"x12" cement concrete solid block masonry <b>4 to 6 inches (102 mm to 152 mm)</b> thick using graded screened bajri 3/4 inch (19 mm) and down gauge set in <b>cement mortar 1:6</b> including scaffolding, raking out joints and curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item #44+92+100	Ground Floor	10392 Cft	100 Cft	15,933.28	1,655,786
	Item # 44+92+100+70	First Floor	10392 Cft	100 Cft	16,757.05	1,741,393
	Item # 34+92+100+70+71	Second Floor	10392 Cft	100 Cft	16,579.03	1,722,893
	Item # 44+92+100+70+71 +71	Roof	11336 Cft	100 Cft	18,116.01	2,053,631

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
4.5	Code-110 Page # 76, 80 & 81  Item # 34+92+75+68	Providing and laying 1:3:6 machine made standard size 6"x8"x12" cement concrete solid block masonry <b>more than 6 inches (152 mm) thick in steps, stairs</b> of approved design using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking out joints and curing etc. complete in ground floor superstructure etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.  FOR BLOCK MASONRY STEPS	1919 Cft	100 Cft	17,532.37	336,446
<b>Total Carried to Summary</b>						<b>11,535,088</b>
5		<b>THERMAL &amp; MOISTURE PROTECTION</b>				
5.1	Code-108  Item # 25 Page #49	Providing and laying 1:9 cement concrete using screened graded bajri 3/4 inch (19 mm) and down gauge in terracing 3 inches (76 mm) average thickness to required slope in panels including form work, consolidation, finishing, curing etc. and painting the surface with plastic bitumen No. 4 at the rate of 15 lbs per hundred square feet (0.73 Kg per s.m) blinded with sand at the rate of 2 cubic feet per hundred square feet (0.06 Kg per s.m) complete" on ground floor roof.  Second Floor & Above	23879 Sft	100 Sft	3,620.88	864,630
<b>Total Carried to Summary</b>						<b>864,630</b>
6		<b>METAL WORKS</b>				
		<b>M.S. / G.I Door Frame</b>				
6.1	Code -119 Item # 43 Page # 240	Providing and fixing M.S. moulded steel door frame of 4" x 2-1/2" (102 mm x 64 mm) manufactured from mild steel sheet of 18 gauge (1.41 mm) conforming to BSS. 1245 having a single rebate size 1-1/2" x 1/2" (38 mm x 13 mm) with provision of 3 Nos. M.S. plate, section 1-1/2" x 1/4" (38 mm x 6 mm), (2 Nos. 6 inch long welded with frame at not less than 10 points and 1 No., 12 inch long welded with frame at not less than 20 points), with holes and threads for fixing steel hinges, fitted with one locking box of same sheet (point welded inside the frame), 6 Nos. 6 inches long flat iron fixing lugs, of 1-1/4" x 3/16" section, treated with special red oxide primer coat all around including cutting holes and filling the cavity with cement concrete 1:2:4 etc. in any floor at any height. etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	1062 Rft	Rft	157.12	166,861
6.2	Code -122 Item #159 Page # 333	Painting Iron work with <b>synthetic enamel paint</b> of approved make and shade two coats over and including the cost of one priming coat at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	1193 Sft	100 Sft	2,776.62	33,125.00
6.3	Code -119 Item #69 Page # 244	Providing and fixing double glazed Bronz anodized or Powder Coated aluminium Sliding windows as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan Cables and A.C.P. (fixing through their approved fabricators), Executive model section double or single glazed 101mm x 37mm and 2mm thick including the cost of aluminium netting ,fitting, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	4100 Sft	Sft	683.72	2,803,252.00

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
6.4	Code -119 Item #60 Page # 242	Providing and fixing fully glazed Bronz anodized or powder coated aluminium Fixed windows Partition as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan cable and A.C.P. (fixing through their approved fabricators) deluxe model box section 101.76mm x 44.50mm and 2mm thick including the cost of aluminium fittings, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	4988 Sft	Sft	330.23	1,647,187.00
6.5	Code -119 Item #119 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc. including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height.	8640 Sft	Sft	88.91	768,182.00
6.6	Code -119 Item #53 Page # 242	Providing and fixing G.I. pipe railing of 2" (50 mm) diameter, comprising, vertical posts and horizontal bracing of G.I. pipe of the same dia as per design including cost of specials, bends, threading, cutting and making good the floor or wall of any kind in cement concrete 1:2:4 etc. 'complete in any floor.	1140 Rft	Rft	374.72	427,181.00
<b>Total Carried to Summary</b>						<b>5,845,788</b>
<b>7</b>		<b>WOOD WORKS</b>				
7.1	Code-120  Item # 2 Page # 259	<b>Door Frame</b> Providing and fixing best quality deodar frames for doors, windows, ventilators, clerestory windows, shelves, partitions, trellis work, etc., as required .  G.Floor  F.Floor  S.Floor & Roof	46 Cft  42 Cft  56 Cft	Cft  Cft  Cft	4,595.14  4,595.14  4,595.14	211,376.00  192,996.00  257,328.00
7.2	Code-120 Item # 63 Page # 265	<b>Door Shutter</b> Providing and fixing 1-1/2 inches (38 mm) thick pressed veneered door shutters <b>fully flushed with commercial ply wood</b> veneering on all faces and sides fixed over deodar wood cavities core and frame work of not less than 4 inches (102 mm) wide strip around with approved brass hinges and tower bolts etc., as required .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	4128 Sft	Sft	655.18	2,704,583.00
7.3	Code-122 Item # 189 Page # 336	<b>Polish &amp; Paint</b> Providing & Applying French or spirit polishing, two coat of approved make on wood work at any height in any floor .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.  For Door Frame	4545 Sft	100 Sft	1,878.96	85,399.00
7.4	Code-122 Item # 156 Page # 333	Painting wood work with super gloss enamel paint of approved make and shade two coats over and including the cost of one coat of priming complete at any height in any floor .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.  Door Shutter	3181 Sft	100 Sft	2,596.16	82,584.00
<b>Total Carried to Summary</b>						<b>3,534,266</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
<b>8</b>		<b>FLOOR FINISHES</b>				
8.1	Code-117	<b>Mosaic Tiles</b> Providing and laying 1 inch (25 mm) thick floor of <b>mosaic marble chips tiles 12" X 12" X 1"</b> (1/2 inch topping 1/2" base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) <b>in white cement</b> with approved marble chips in ground floor over 1" (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, Jointing and washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 79 Page# 199	Ground Floor	11532 Sft	100 Sft	12,237.02	1,411,173.00
	Item # 79+94 Page# 199 & 201	First Floor	9327 Sft	100 Sft	12,432.15	1,159,547.00
	Item # 79+94+95 Page# 199 & 201	Second Floor	9327 Sft	100 Sft	12,564.84	1,171,923.00
8.2	Code-117 Item # 159 Page# 209	<b>Porcelain Tiles</b> Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding <b>1600 Sqcm</b> each, <b>(Pak made)</b> on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer incharge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 159 Page# 209	G.Floor	8671 Sft	100 Sft	17,882.39	1,550,582.00
	Item # 159 Page# 209	First Floor	9064 Sft	100 Sft	17,882.39	1,620,860.00
	Item # 159 Page# 209	Second Floor	9064 Sft	100 Sft	17,882.39	1,620,860.00
<b>Total Carried to Summary</b>						<b>8,534,945</b>
<b>9</b>		<b>WALL FINISHES</b>				
9.1	Code-122	<b>Internal Wall Plaster</b> 1/2" (13 mm) thick cement plaster 1:6 on wall columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	60490 Sft	100 Sft	1,730.74	1,046,925
	Item # 6+87 Page # 320 & 327	First Floor	60490 Sft	100 Sft	1,884.61	1,140,001
	Item # 6+87+90 Page # 320, 327 & 328	Second Floor	60490 Sft	100 Sft	2,015.07	1,218,916
	Item # 6+87+90+90 Page # 320, 327 & 328	Roof	761 Sft	100 Sft	2,145.53	16,327

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
9.2	Code-117 Item # 159 Page# 209	<b>Dado &amp; Skirting</b> Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding <b>1600 Sqcm</b> each, <b>(Pak made)</b> on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer incharge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 159 Page# 209	G.Floor	2450 Sft	100 Sft	17,882.39	438,119
	Item # 159 Page# 209	First Floor	2450 Sft	100 Sft	17,882.39	438,119
	Item # 159 Page# 209	Second Floor	2450 Sft	100 Sft	17,882.39	438,119
9.3	Code-118 Item # 55 + 58 Page# 219	Providing and fixing marble mosaic tile 12" X 6" X 3/4" (305 mm X 152 X 19 mm) with chips No. 0 to 4 in <b>dado and skirting</b> of approved design in light shade over 1 /2 inch (13 mm) thick base of cement mortar 1:3 in ground floor setting of tiles in slurry of grey cement over mortar base including filling of joints and washing the tiles with cement slurry of matching colour curing, grinding, rubbing and polishina etc. complete.				
	Code-118 Item # 55 + 58 Page# 219	G.Floor	1532 Sft	100 Sft	14,274.50	218,685
	Code-118 Item # 55 + 58+60 Page# 219	F.Floor	1233 Sft	100 Sft	14,567.19	179,613
	Code-118 Item # 55 + 58+60+61 Page# 219	S.Floor	1233 Sft	100 Sft	14,813.05	182,645
9.4	Code-122	<b>Puddlo Plaster</b> 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8	U.G.W.T Plaster	550 Sft	100 Sft	2,367.12	13,019
	Item # 8+88	O.H.W.T Plaster	350 Sft	100 Sft	2,572.28	9,003
9.5	Code-122	Providing and mixing water proofing agent pudlo in cement mortar of any description in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 30	U.G.W.T	15 Kg	Kg	86.15	1,292
	Item # 30	O.H.W.T	10 Kg	Kg	86.15	862
9.6	Code-122 Item # 162	Painting with (ICI) Dulux plastic emulsion paint VIP of approved shade two coats over and including the cost of one priming coat complete over plastered surface at any height in any floor .	182261 Sft	100 Sft	2,742.08	4,997,742
<b>Total Carried to Summary</b>						<b>10,339,387</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
10		<b>CEILING FINISHES</b>				
		<b>Internal Ceiling Plaster</b>				
10.1	Code-122	1/2" (13 mm) thick cement plaster 1:6 on ceilings cantilever soffits others etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	19663 Sft	100 Sft	1,730.74	340,315
	Item # 6+87 Page # 320 & 327	First Floor	22686 Sft	100 Sft	1,884.61	427,543
	Item # 6+87+90 Page # 320, 327 & 328	Second Floor	21098 Sft	100 Sft	2,015.07	425,139
	Page # 320, 327 & 328	Roof	364 Sft	100 Sft	2,145.53	7,810
10.2	Code-122 Item # 151	Distempering with vinyl distemper (ICI) Dulux Paintex of approved make and shade in two coats over and including the cost of one priming coat of lime wash including sand papering, dusting, and filling the holes, cracks and inequalities, if any, at any height in any floor.	63447 Sft	100 Sft	1,053.54	668,440
10.3	Code-124 Item # 182 Page# 361	Providing and fixing Gypsum board 2' x 2' x 12mm tiles ceiling including Aluminum T & L angle 1" x 1" i.c hanger clips jointing clips and G.I Wire etc complete as required in any floor.	6403 Sft	Sft	71.69	459,031
10.4	Code-124 Item # 183 Page# 361	Providing and fixing mineral fiber tiles 2' x 2' x 12mm ceiling including T & L angle hanger clips jointing clips and G.I Wire etc complete as required in any floor.	2744 Sft	Sft	77.49	212,633
<b>Total Carried to Summary</b>						<b>2,540,911</b>
11		<b>EXTERNAL FINISHES</b>				
		<b>External Plaster</b>				
11.1	Code-122	3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8 Page # 320	Ground Floor	5557 Sft	100 Sft	2,367.12	131,541
	Item # 8+88 Page # 320 & 327	First Floor	5557 Sft	100 Sft	2,572.28	142,942
	Item # 8+88+91 Page # 320, 327 & 328	Second Floor	3969 Sft	100 Sft	2,746.22	108,997
	Item # 8+88+91+91 Page # 320, 327 & 328	Roof	5172 Sft	100 Sft	2,920.16	151,031
11.2	Code-122 Item # 83 Page # 327	Extra for providing horizontal or vertical joints or grooves 3/8" x 1/4" (9.5 mm x 6.4 mm) size of approved design over item No. 11.1	5172 Sft	100 Sft	518.48	26,816
11.3	Code-122	Painting three coats with <b>weather shield paint deluxe (ICI)</b> make of approved shade on plaster surface (External) and including the cost of cleaning the surface, sand papering etc. complete at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 172	Ground Floor to Roof	5172 Sft	100 Sft	1,406.88	72,764

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
11.4	Code-122	Providing and applying <b>colour Crete</b> 1/4" (6.4 mm) 1:1:2 (1 white cement mixed with pigment, 1 marble powder and 2 marble chips zero No.) with horizontal & vertical joints or Grooves including dragging the surface with wire brush complete with curing etc., over base of 3/4" (19 mm) thick cement plaster 1:3 in plinth, mezzanine and ground floor including chiseling the surface to give texture of stone including the cost of base course etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 79+82+83 Page # 326 & 327	Ground Floor	13375 Sft	100 Sft	8,043.11	1,075,766
	Item # 79+82+83+88	First Floor	14051 Sft	100 Sft	8,248.27	1,158,964
	Item # 79+82+83+88+91 Page # 326 & 327	Second Floor	12808 Sft	100 Sft	8,422.21	1,078,717
11.5	Item # 88 Page #149 &150	Providing and fixing 1:2 <b>precast reinforced or plain cement concrete jali</b> or louvers upto 2 inches (51 mm) thick in required shape including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in ground floor (no deduction for holes shall be made)				
	Item # 88	Ground Floor	350 Cft	100 Cft	33,815.30	118,354
	Item # 88+94	First Floor	350 Cft	100 Cft	34,478.61	120,675
	Item # 88+94+95	Second Floor	350 Cft	100 Cft	34,995.59	122,485
<b>Total Carried to Summary</b>						<b>4,309,052</b>
<b>12</b>		<b>EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)</b>				
		<b>C.C 1:2:4 Floor</b>				
12.1	Code-117	Providing and laying floors of 3 inches (76 mm) thick 1:2:4 cement concrete using graded screened bajri 3/4 inch (19 mm) and down gauge in ground floor laid in panels including form work, consolidation, finishing and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the				
	Item # 7	Ground Floor	2569 Sft	100 Sft	4,289.49	110,197
12.2	Code-117 Item # 158 Page# 208	Providing and laying in floor C.C. 1:2:4: <b>tuff pavers 2" thick</b> of approved design and colour and pattern ( <b>average strength 7000 psi</b> ) laid on sand cushion filling of joint with sand and warring etc. complete as per direction of Engineer In charge. (the cost of sand cushion is included) complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
			11690 Sft	Sft	61.64	720,572
		<b>CC Tiles</b>				
12.3	Code-117 Item # 97 Page# 202	Providing and laying floor 1 inch (25 mm) thick of cement tiles 12" X 12" X 1" (1 /2" topping and 1 /2 inch base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in grey cement in ground floor over 1 inch (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, jointing and washing the tiles with neat cement slurry, polishing and curing etc. complete including the cost of mortar. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
			10761 Sft	100 Sft	8,725.02	938,899
<b>Total Carried to Summary</b>						<b>1,769,668</b>



S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
<b>NON-SCHEDULE ITEMS</b>						
7		<b>WOOD WORKS</b>				
		<b>FIXED GLAZING</b>				
7.1	N.S.1	Providing, fabricating and fixing, fixed glazing including glass partition wall, fully flushed door shutter and MDF partition wall, comprising of 2" x 4" best quality imported OAK wood framing with fixed glass panels & MDF portation including 1-1/2" thick solid core flush door shutter with 5mm thick commercial ply (Oak finished) over rough wood cavities core and frame work of not less than 6 inches (150 mm) wide strip all around hollow area except framing to be filled with the approved rough wood, 1-1/2" X 5/8" thick solid oak wood edge lipping all around the shutter, with or without fan light and with or without vision panel including termite treatment (using anty termite clear liquid by Jaffar btothers or approver equveleint), using 6mm thick clear glass for glass partition panel & 5mm thick for vision panel all glass by (Pilkington / Emirates glass or approved equivalent & lamination film thickness not less than 300 micron by 3M or approned equivalent ), 3/8" thick MDF either sides etc, complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		DW1	523 Sft	Sft		
		DW2	172 Sft	Sft		
		DW2a	252 Sft	Sft		
		DW3	679 Sft	Sft		
		DW3a	746 Sft	Sft		
		DW4	338 Sft	Sft		
		DW5a	844 Sft	Sft		
		DW5	641 Sft	Sft		
		DW6	315 Sft	Sft		
		DW7	152 Sft	Sft		
		DW8	574 Sft	Sft		
		DW8a	736 Sft	Sft		
		DW9	212 Sft	Sft		
		DW9a	155 Sft	Sft		
		DW10	384 Sft	Sft		
7.2	N.S.1	Providing, fabricating and fixing, fixed glazing including glass partition and MDF partition wall, comprising of 2" x 4" best quality imported OAK wood framing, 6mm thick clear glass by (Pilkington / Emirates glass or approved equivalent) & fixing 3/8" thick MDF either sids including termite treatment (using anty termite clear liquid by Jaffar btothers or approver equveleint), 3/8" thick MDF either sides etc, complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		FG1	180 Sft	Sft		

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
7.3	N.S.I	<b>FIRE RATED DOORS</b> Providing and fixing wooden fire rated doors single & double leaf as per drawing with frames factory fabricated meet the requirements of the BM TRADA "Q" Mark Third Party Accredited scheme, tested in accordance with BS476 Pt22 1987 achieving a FD 60 minutes fire resisting rating. including standard fire door hardware fire rated locks or exit devices with latching units and exposed door closer (dorma or equivalent) key and thumb turn concealed /SS with SS hinges complete 50mm wall size frame and spray paint finish etc., complete from Safeco or approved as per specifications & relevant drawings, and to the entire satisfaction of the Engineer(at any height & any floor)	198 Sft	Sft		
7.4	N.S.I	<b>Wooden Cabintes</b> Providing making and fixing in position <b>floor mounted lower cabinets</b> (Pantry etc) as per drawing at any height / floor, made of 3/4" thick coloured laminated (both face) Lasani board shutter free from formaldehyde including all around OAK wood lipping kitchen cabinet, 3" x 1-1/2" thick Partal wood frame, complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc, including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved as per manufacturer's instruction & specification including all required hardware's for fixing etc,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. <b>(Front face will be measured for payments)</b>				
		Ground Floor	105 Sft	Sft		
		First Floor	105 Sft	Sft		
		Second Floor	105 Sft	Sft		
7.5	N.S.I	Providing making and fixing in position wall mounted cabinets for (Kitchen etc) as per drawing at any height / floor, made of 3/4" thick colored laminated (both side) Lasani board shutter free from formaldehyde including all around Deodar wood lipping 3/8" thick, 3" x 1-1/2" thick Partal wood frame, 6mm one side laminated Lasani board back complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc, including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved equivalent as per manufacturer's instruction & specification including all required hardware's for fixing etc, complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. <b>(Front face will be measured for payments)</b>				
		Ground Floor	105 Sft	Sft		
		First Floor	105 Sft	Sft		
		Second Floor	105 Sft	Sft		
<b>Total Carried to Summary</b>						
11		<b>EXTERNAL FINISHES</b>				
11.1	N.S.I	Providing & Laying Natural Sand stone on wall (stright, curved, arches etc) with cement sand mortar 1:2 and in any pattern in as per direction of the engineer-in-charge including the cost of curing, making the stone surface smooth etc complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	15876 Sft	Sft		

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
11.2	N.S.I	Providing, fabricating and fixing <b>Roof Skylight</b> comprising of timber (oak wood) angular trusses / purlins / rafters with 1/2" laminated and tempered tinted (green) glass, infill panels fixed in wooden framing all as per details and design drawings. All timber sections & members to be painted (ICI, Berger, Jotun or equivalent) enamel paint (3 coats + 1 under coat) of approved colour. skylight to be fixed on top of RCC lintels / beams above high level windows Contractor is to be ensure stability of Skylight structure due to self weight (dead load) & high wind pressure & uplift etc.complete in all respect as per drawings, specification and as directed by the Engineer. (Shop drawing and load /wind calculation to be provided for approval before fabrication)	548 Sft	Sft		
11.3	N.S.I	<b>External Building LOGO's</b> Provide, make, finish and fix in position LOGO & LETTERING (" <b>SINDH MADRESSATUL ISLAM UNIVERSITY -FACULTY OF MEDIA STUDIES &amp; SOCIAL SCIENCES</b> ") lettering with 48" dia Logo) on External walls including 2" thick Plaster in 1:4 cement, sand mortar with LOGO made of Stainless Steel Sheet (size as shown in drawing), fixed to walls with 3" long steel rawal bolts, strictly according to drawings, this includes three coats of plastic emulsion paint and preparation of surface with filling manufactured by ICI, all nails, screws, glues etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.  a) Lettering with 4' dia Logo  b) Logo Plaster (6'-0" x 24'-6")	70 Each 300 Sft	Each Sft.		
11.4	N.S.I	<b>Rain Water Spouts</b> Providing, Making and Fixing in position R.C.C Precast Rain Water spouts (size as shown in drawing), complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	30 Each	Each		
11.5	N.S.I	Providing, Making and Fixing ornamental columns, and ball finial comprising of artificial sand stone round & other geometrical shape over around windows & parapet wall (size as shown in drawing), complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.  a) Ornamental Pre cast Columns  b) Ornamental Pre cast ball finial with base	320 Rft 36 Nos	Rft Nos		
11.6	N.S.I	Providing & Laying pre cast cornices with 3000 psi concrete over columns, walls, arches & where required with cement sand mortar 1:2 in any pattern in as per direction of the engineer-in-charge including the cost of curing etc complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	756 Rft	Rft		
<b>Total Carried to Summary</b>						

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
12		<b>EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)</b>				
12.1	N.S.I	Providing and laying Terrazzo tiles/slab with bull nosing in <b>one piece /full length (up to 5 feet long) 1-1/2" thick for Treads</b> consisting of 3/4" thick topping 1:2 (One gray cement 2 approved marble chips No. 0 to 4 & chapcha) <b>in white cement</b> over a base 1:2:4 (One cement, two sand & four crush) cement concret 3/4" thick in any floor laid with cement sulry/dry over existing surface including jointing with approved quality grouting material & grinding, polishing etc complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	1207 Sft	Sft		
12.2	N.S.I	Providing and laying <b>Terrazzo tiles/slab in one pieces for Risers at</b> consisting of 1/2" thick 1:2 (One gray cement 2 approved marble chips No. 0 to 4) laid with cement sulry/dry board over existing surface in any floor including jointing with approved quality grouting material & grinding, polishing complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	754 Sft	Sft		
12.3	N.S.I	Providing and making <b>Planter/ land escaping</b> as shown on drawing all works comprising (earth filling, sweet earth with manure plants and grassing compacting, curing, finishing & leveling) etc, excluding Tree, complete in all respects as per drawing, standard, specifications and direction of the Engineer.	1255 Sft	Sft		
<b>Total Carried to Summary</b>						

# **ELECTRIC WORK**

SUMMARY OF COST

S. NO.	DESCRIPTION	TOTAL AMOUNT IN PAK RUPEES
<b>NON-SCHEDULE ITEMS</b>		
1	INTERNAL ELECTRIFICATION	
2	L.V. PANELS & DISTRIBUTION BOARDS	
3	LOW VOLTAGE CABLES AND WIRES	
4	CONDUITS & PIPES	
5	WIRING ACCESSORIES	
6	LIGHT FIXTURE & FANS	
7	EXTERNAL LIGHTING	
8	UPS SYSTEM <b>(On HOLD)</b>	
9	CABLE TRAY	
10	EARTHING SYSTEM	
11	LIGHTNING PROTECTION SYSTEM (LPS)	
	<b>TOTAL AMOUNT</b>	

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>NON-SCHEDULE ITEMS</b>					
<b>1</b>	<b>INTERNAL ELECTRIFICATION</b>				
<b>a)</b>	<b><u>3 WIRE IN PVC RECESSED CONDUIT</u></b>				
i	Wiring for sub-main with 3x 1.5 mm <sup>2</sup> , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4") dia PVC conduit recessed in the wall, column and roof etc as required.	19,800	Per Mtr.		
ii	Wiring for sub-main with 3x 2.5 mm <sup>2</sup> , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4") dia PVC conduit recessed in the wall, column and roof etc as required.	5,001	Per Mtr.		
iii	Wiring for sub-main with 3x 4 mm <sup>2</sup> , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4") dia PVC conduit recessed in the wall, column and roof etc as required.	7,490	Per Mtr.		
iv	Wiring for sub-main with 3x 6 mm <sup>2</sup> , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 25 mm (1") dia PVC conduit recessed in the wall, column and roof etc as required.	1,175	Per Mtr.		
<b>b)</b>	<b><u>4 CORE CABLE IN SURFACE PVC CONDUIT</u></b>				
i	Wiring for sub-main with 4 core, 10 mm <sup>2</sup> , stranded copper conductor, PVC insulated & PVC sheathed circular/flat cable in 40 mm (1½") dia PVC conduit fitted on surface as required.	125	Per Mtr.		
<b>c)</b>	<b><u>BATTEN/ ANGLE HOLDER, CEILING ROSE, BELL/ INDICATORS</u></b>				
i	Providing & fixing 6 Amps plastic ceiling rose on wooden Round block/Round Cover fitted on surface including connection as required.	110	Each		
<b>d)</b>	<b><u>CEILING FANS</u></b>				
i	Providing & installing 140 Cm (56") sweep ceiling fan with blades, canopy, standard length of down rod including connection with 14.0076" flexible wire complete as required. (without regulator) Millat/Pak/Asia/ Younas/Climax/ Royal.	90	Each		

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
e)	<b><u>PLASTIC BODY EXHAUST FANS</u></b>				
i	Providing & installing 20 Cm (8") sweep,Plastic body Exhaust fan complete with blades, motor, etc fitted in existing hole including connection with 14/.0076" flexible wire complete as required Millat/Pak/Asia/ Younas/Climax/ Royal.	2	Each		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					



S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>2</b>	<b>L.V. PANELS &amp; DISTRIBUTION BOARDS</b>				
a)	Supply, installation, testing & commissioning of Wall/Flush mounted Main Distribution Board (MDB) / Sub Main Distribution Board (SMDB) / Distribution Boards (DB), made with 16 SWG sheet steel metal, as per single line diagram, dust protected, vermin proof housing coated with approved color having all the necessary switching & protections, including all mounting accessories as per specifications and drawings, complete in all respect.				
i	MDB-SMNS	1	No.		
ii	SMDB-NS-1F	1	No.		
iii	SMDB-NS-2F	1	No.		
iv	DB-NS-GF1	1	No.		
v	DB-NS-GF2	1	No.		
vi	DB-NS-GF-AC	1	No.		
vii	DB-NS-GF-ICT	1	No.		
viii	DB-NS-1F1	1	No.		
ix	DB-NS-1F2	1	No.		
x	DB-NS-1F-AC	1	No.		
xi	DB-NS-1F-ICT	1	No.		
xii	DB-NS-2F1	1	No.		
xiii	DB-NS-2F2	1	No.		
xiv	DB-NS-2F-AC	1	No.		
xv	DB-NS-2F-ICT	1	No.		
xvi	DB-NS-ROOF	1	No.		
b)	Supply, installation, testing & commissioning of following Isolators, in 16 SWG sheet steel enclosure with neutral and earth terminal strips, including all mounting accessories as per specification & drawing, complete in all respect.				
i	40A, TPN Isolator	2	Nos.		
ii	30A, TPN Isolator	6	Nos.		
iii	32A, SPN Isolator	46	Nos.		
iv	20A, SPN Isolator	49	Nos.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>3</b>	<b>LOW VOLTAGE CABLES AND WIRES</b> Supply, laying, termination and commissioning of following copper conductor cable In already laid PVC conduit / cable tray / trench as required as per drawing and specification ,complete in all respect.				
a)	<b>4 Core - Cu.XLPE/PVC Cable (600/1000V)</b>				
i	4 Core - 120 Sq.mm	25	Mtr.		
ii	4 Core - 95 Sq.mm	15	Mtr.		
iii	4 Core - 70 Sq.mm	40	Mtr.		
iv	4 Core - 50 Sq.mm	30	Mtr.		
v	4 Core - 25 Sq.mm	25	Mtr.		
vi	4 Core - 16 Sq.mm	55	Mtr.		
b)	<b>1 Core - CU/PVC Cable as ECC</b>				
i	1 Core - 70 Sq.mm Cu/PVC Cable	25	Mtr.		
ii	1 Core - 50 Sq.mm Cu/PVC Cable	15	Mtr.		
iii	1 Core - 35 Sq.mm Cu/PVC Cable	40	Mtr.		
iv	1 Core - 25 Sq.mm Cu/PVC Cable	30	Mtr.		
v	1 Core - 16 Sq.mm Cu/PVC Cable	80	Mtr.		
vi	1 Core - 10 Sq.mm Cu/PVC Cable	125	Mtr.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>4</b>	<b>CONDUITS &amp; PIPES</b>				
a)	Providing and laying of following size (inner dia) PVC / UPVC Conduit as race ways with all accessories recessed / surface on wall / column / under floor for Power. As per specifications and drawings, complete in all respect.				
i	38 mm dia PVC	50	Mtr.		
ii	50 mm dia PVC	40	Mtr.		
b)	Providing and laying of UPVC (Class-D) pipe having dia of following size. Buried in ground as per drawing. Including excavation for laying of pipe and backfilling with clean sand (under and above pipe), compaction, concrete, plugging of pipe ends etc. as shown on drawing complete in all respect.				
i	100 mm dia UPVC (Class-D)	6	Mtr.		
c)	Providing and Construction of Manhole Size 600x600x900 mm deep, 6" thick, concrete 1:2:4 ratio with 600mm round heavy duty cast iron cover, 100% water proof, complete in all respect.	1	No.		
d)	Providing & installing of Pull Box as per drawing and specification, complete in all respect.	3	No.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>5</b>	<b>WIRING ACCESSORIES</b>				
a)	Supply, installation, testing & commissioning of following 10/13/15/20A, gang type switches, Dimmer Switches, Sockets including 16 SWG Sheet Steel powder coated back Boxes with earth terminal, recessed in wall, with all accessories as per specification, complete in all respects.				
i	10A, One Gang Switch	28	Nos.		
ii	10A, One Gang Switch (2-Way)	23	Nos.		
iii	10A, Two Gang Switch	48	Nos.		
iv	10A, Three Gang Switch	26	Nos.		
v	10A, Four Gang Switch	45	Nos.		
vi	10A, Double Pole Switch	19	Nos.		
vii	20A, Double Pole Switch	13	Nos.		
viii	ON & OFF Push Button	27	Nos.		
ix	One Gang Dimmer with 10A Switch	6	Nos.		
x	Two Gang Dimmer with 10A Switch	42	Nos.		
xi	10A, 2-Pin 1-Gang Switched Socket Outlet	227	Nos.		
xii	10A, 2-Pin 1-Gang Switched Socket Outlet Weatherproof type	4	Nos.		
xiii	13A, 3-Pin Flat 2-Gang Switched Socket Outlet	307	Nos.		
xiv	13A, Unswitched Spur Outlet	15	Nos.		
xv	15A, 3-Pin Switched Socket Outlet	6	Nos.		
xvi	Flex Outlet	32	Nos.		
xvii	16A, 3-pin Three Phase Industrial Socket with plug top	3	Nos.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>6</b>	<b>LIGHT FIXTURE &amp; FANS</b>				
a)	Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
i	Type - D1	227	Nos.		
ii	Type - D2	106	Nos.		
iii	Type - D3	96	Nos.		
iv	Type - D4	34	Nos.		
v	Type - D5	61	Nos.		
vi	Type - D6	15	Nos.		
vii	Type - LD1	150	Nos.		
viii	Type - LD2	398	Nos.		
ix	Type - LD3	60	Nos.		
x	Type - T1	3	Nos.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>7</b>	<b>EXTERNAL LIGHTING</b>				
a)	Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
i	Type - FS1	16	Nos.		
ii	Type - S1	24	Nos.		
iii	Type - R1	53	Nos.		
iv	Type - W1	32	Nos.		
v	Type - W2	13	Nos.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>8</b>	<b>UPS SYSTEM</b>				
a)	Providing, installing, testing & commissioning of True Online Double Conversion UPS rating 50 kVA Three Phase in, Three Phase out, minimum 0.9 output power factor with 10 minutes battery backup, batteries with related DC cables from UPS to batteries, external By-pass and all accessories as per specification & drawings, complete in all respect.		No.		
b)	Providing, installing, testing & commissioning of True Online Double Conversion UPS rating 40 kVA Three Phase in, Three Phase out, minimum 0.9 output power factor with 10 minutes battery backup, batteries with related DC cables from UPS to batteries, external By-pass and all accessories as per specification & drawings, complete in all respect.		No.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>9</b>	<b>CABLE TRAY</b>				
a)	Providing, fabricating, erecting, fixing and installing of following size of base perforated Cable Tray, Fabricated with 16 SWG MS Sheet steel Hot dip Galvanized including all installation accessories (Hot Dip Galvanized) such as appropriate sizes and lengths of MS Rod / Angle Iron Supports and Rawl Bolts, including cutting, welding, jointing and necessary required hardware etc. Complete in all respect as shown in drawings and specification or as directed by the Engineer.				
i	6" x 2" (150mm x 50mm)	155	Mtr.		
ii	12" x 2" (300mm x 50mm)	97	Mtr.		
iii	18" x 2" (450mm x 50mm)	35	Mtr.		
iv	24" x 2" (600mm x 50mm)	15	Mtr.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					



S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>10</b>	<b>EARTHING SYSTEM</b>				
a)	Supply, installing, testing and commissioning of following items for complete earthing system including all connecting accessories as per drawings and specifications complete in all respect.				
i	Earth pit with Rod type earth electrode, 3/4" dia and 3 meters long copper rod .	2	Nos.		
b)	Supply, installing, testing and commissioning of following items for complete clean earthing system including all connecting accessories as per drawings & specifications complete in all respect.				
i	Earth pit with Rod type earth electrode, 3/4" dia and 3 meters long copper rod .	1	No.		
c)	Supply, Installation, Testing and Commissioning of Earth Copper Bar (MDB) 300x50x6 mm for earthing system as per drawings and instruction of consultant.	2	Nos.		
d)	Supply, laying, testing and commissioning of 1x16 Sq.mm PVC insulated Cu. Conductor cable as earth continuity conductor (ECC) in 25 mm dia uPVC conduit, complete in all respect.	30	Mtr.		
e)	Supply, laying, testing and commissioning of 1x25 Sq.mm PVC insulated Cu. Conductor cable as earth continuity conductor (ECC) in 25 mm dia uPVC conduit, complete in all respect.	10	Mtr.		
f)	Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable as earth continuity conductor (ECC) in 32 mm dia uPVC conduit, complete in all respect.	30	Mtr.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
11	<b>LIGHTNING PROTECTION SYSTEM (LPS)</b>				
a)	Supply, installation, testing and commissioning of 27mm x 2mm Tinned Copper Tape to be run on roof and on the elevation of the building as required and shown on drawings including all fixing accessories etc., as per specification, as per site requirement necessary for the functioning of the system and drawing, complete in all respect.	230	Mtr.		
b)	Supply, installation, testing and commissioning of Early Streamer Emission (ESE) Air Terminal mounted on 2 meter elevation mast, as per drawing, complete in all respect and having following specifications:  Efficiency: 60 micro seconds Lightning current withstanding test (10/350µs): 100 kA  ESE Central Rod: Nickel Plated Copper Metal Housing : Stainless Steel 316L Protection Radius : 42-49 meter at 2 meter height	1	No.		
c)	Providing and installation of 2 meter high elevation mast consisting side wall mounting bracket for installation and fixing of ESE Air Terminal, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	1	No.		
d)	Providing and installation of pyramid holdfasts / studs filled with cement for holding and supporting the flat tape conductor, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	80	Nos.		
e)	Providing and installation of lightning flash counter as per drawing and specification as per site requirement necessary for the system, complete in all respect.	1	No.		
f)	Providing and installation of Earth Electrode Copperbond earth rod 3 meters and clamp, Polypropelene earth pit, as per drawing and specification, complete in all respect.	6	Nos.		
g)	Providing and installation of Test Clamp and Guard Tube 2 m in length, as per drawing and specification, as per specification, as per site requirement necessary for the functioning of the system, complete in all respect.	2	Job.		
h)	Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable in 32 mm dia uPVC Pipe at ground level connecting Lightning protection pits to power earthing pits, complete in all respect.	10	Mtr.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

# **ELV WORK**

## SUMMARY OF COST

S. NO.	DESCRIPTION	TOTAL AMOUNT IN PAK RUPEES
<b>A. SCHEDULE ITEMS</b>		
	SUB-TOTAL-A Rs.	0
	Add _____% Above/Below/At par on Electrical Works of Composite Schedule of Rates PWD-2004	
	TOTAL-A Rs.	0
<b>B. NON-SCHEDULE ITEMS</b>		
1	CONDUITS & PIPES	
2	VOICE, DATA COMMUNICATION & CCTV CABLING SYSTEMS (Passive Equipment Only) <b>(Equipments &amp; cabling on HOLD, only conduiting in Contractor's Scope)</b>	
3	PA (PUBLIC ADDRESS / VA (VOICE EVACUATION) SYSTEM <b>(Equipments &amp; cabling on HOLD, only conduiting in Contractor's Scope)</b>	
4	PUBLIC ADDRESS / BACKGROUND MUSIC SYSTEM FOR SEMINAR HALL <b>(On HOLD)</b>	
5	ACCESS CONTROL SYSTEM <b>(On HOLD)</b>	
6	CCTV SYSTEM <b>(On HOLD)</b>	
7	ADDRESSABLE FIRE ALARM SYSTEM <b>(Equipments &amp; cabling on HOLD, only conduiting in Contractor's Scope)</b>	
8	SELF CONTAINED EMERGENCY LIGHTS	
9	CABLE TRAY	
	TOTAL-B Rs.	
	TOTAL AMOUNT (A+B)	

**BILL OF QUANTITIES**

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
<b>PART-B (NON-SCHEDULE ITEMS)</b>						
1		<b>CONDUITS &amp; PIPES</b>				
a)		Providing and laying of following size UPVC pipe of Class D for Telecommunication Cable (copper / optic fiber). Buried in ground / under roads / under floor as per specification. Including excavation for laying of pipe, bricks, warning tape and backfilling with new and fresh soil etc., as shown on the drawing, complete in all respect.				
i		2" dia UPVC	35	Mtr.		
b)		Providing and Construction of Manhole Size 2' x 2' x 3' mm deep 6" thick concrete 1:2:4 ratio with 2' round heavy duty cast iron cover, 100% water proof, complete in all respect. (For Incoming Telecommunication cables ).	1	No.		
c)		Providing & installing of Pull Box as per drawing and specification, complete in all respect.	1	No.		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;</b>						

**BILL OF QUANTITIES**

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
2		<b>VOICE, DATA COMMUNICATION &amp; CCTV CABLING SYSTEMS (Passive Equipment Only)</b>				
a)		Providing, installation, testing and commissioning of following Data / Voice Cabinets, for patch panel, Fiber panels, adapter, PDU's,Fans and space for active switches as it may require to accommodate complete the entire passive and active network as per the single line diagram drawing and specification, complete in all respect.				
i		42U Data Rack in IT Room & Server Room (800mmx1000mm)		Nos.		
b)		Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for Voice with shutter type and 16 SWG back box including tagging,as per drawing and specification, complete in all respect.		Nos.		
c)		Providing, fixing, testing and commissioning of 4 Pair RJ-45, Cat-6 Simplex Outlet (for Data) with I/O - Shutter type with 16 SWG back box as per drawing and specification, complete in all respect.		Nos.		
d)		Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for Camera with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.		Nos.		
e)		Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for WIFI with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.		Nos.		
f)		Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for Projector with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.		Nos.		
g)		Supply, laying, testing and commissioning of CAT-6, 4 pair cable for Single RJ-45 outlet (Data,Voice, Camera, Wifi, Projector and Access control system) in 25mm dia PVC conduit concealed/surface from each outlet to IDF racks, including tagging and piping with all necessary accessories, complete in all respect. <b>(Cabling on HOLD, only conduiting in Contractor's Scope)</b>	11750	Mtr.		
h)		Supply, laying, testing and commissioning of Cat 5, 25 pair Backbone cable from MTJB to remaining TJB in already laid cable tray including with all the necessary accessories as per drawing and specifications complete in all respect.		Mtr.		
j)		Supply, laying, testing and commissioning of 8 core multi mode OM3 Fiber optic cable from server room remaining IDF Racks in already laid cable tray including with all necessary accessories, as per drawing and specification, complete in all respect.		Mtr.		

**BILL OF QUANTITIES**

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
k)		Supply, installing, testing and commissioning of 24 port Cat 6, RJ 45 UTP Patch Panel fully loaded with tool less jacks and rear cable manager, as per drawing and specification, complete in all respect.		Nos.		
l)		Supply, installing, testing and commissioning of 24 port Fiber Patch Panel fully loaded with pigtails etc., and rear cable manager, as per drawing and specification, complete in all respect.		Nos.		
m)		Supply, installing, testing and commissioning of 19" front/rear (as required) cable organizer between patch panels and active equipment to provide patch cable management including with all necessary accessories, as per drawing and specification, complete in all respect.		Nos.		
n)		Providing, installation, testing and commissioning of CAT-6 UTP (RJ-45 to RJ-45) for the above Patch Panels including with all necessary accessories, as per drawing and specification, complete in all respect.				
i		CAT-6 (1m) Long Patch Cord.		Nos.		
ii		CAT-6 (2m) Long Patch Cord.		Nos.		
o)		Supply, installing, testing and commissioning of following blocks in Telephone junction boxes as per drawing and specification, complete in all respect.				
i		50 Pair IDC Block		Nos.		
ii		100 Pair IDC Block		No.		
p)		Providing, fixing, testing and commissioning of Floor Distribution Box with 1No. Dual RJ-45 Outlet (for Voice and Data), 1No.13A, Duplex Switched Socket Outlet and 1No. 10A, 2-pin Switched Socket Outlet and I/O - Shutter type with 16 SWG back box, as per drawing and specification, complete in all respect.		Nos.		
q)		Installation, testing and commissioning by Manufacturer Authorized Agent / Dealer and handing over complete Voice & Data System to Owner with Providing Training voice data fuke & OTDR Testing,as build drawing,Rack layouts and certification's Principal, complete equipment's Manual and Warranty Documents to Owners representative.		Job.		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;</b>						

BILL OF QUANTITIES

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
<b>3</b>		<b>PA (PUBLIC ADDRESS / VA (VOICE EVACUATION) SYSTEM</b>				
a)		Providing, laying, testing and commissioning of Wiring for complete PA System with 2C - 1.5 Sq.mm shielded, twisted pair Fire Resistant Cable in 25 mm dia PVC conduit concealed as per drawing and specification. Complete in all respect. <b>(Cabling on HOLD, only conduiting in Contractor's Scope)</b>	<b>415</b>	<b>Mtr.</b>		
b)		Supply, wiring and testing of PA Microphone points with Microphone Cable in 25mm dia PVC Conduit, recessed / surface in wall and ceiling, complete in all respects.		Job.		
c)		Supply, installation, testing and commissioning of PA System complete with all connecting accessories comprising of the following equipment, as per drawing and specification, complete in all respects.				
i		System Manager with built in slots for modules and message manager, as per drawing and specification, complete in all respects.		No.		
ii		Remote Microphone for upto 10 Zones with frequency response 100 Hz to 20 KHz and unidirectional electret condenser microphone gooze neck table type with RJ45 connector, shielded twisted pair cable, indicators for power, failure, broadcast switch, covered switch, as per drawing and specification, complete in all respects.		No.		
iii		150W Power Amplifier module with frequency response 40 Hz to 20 KHz and 100V output voltage (EN54 compliant), as per drawing and specification, complete in all respects.		No.		
iv		Power supply manager with RJ45 female connector for connecting the system and cascade connection with shielded twisted pair straight cable and with indications battery check, charging circuit failure, battery failure (EN54 compliant), as per drawing and specification, complete in all respects.		No.		
v		Providing & Connecting of Inter Connects Cables etc.		Job.		
vi		19' Rack Cabinet with Glass Door to accommodate above equipment's located at Security room as per drawing and specification, complete in all respects.		No.		
d)		Supply, installing, testing and commissioning of following type Speakers of Architect Approved color, as per drawing and specification, complete in all respects.				
i		6W Ceiling mounted Speakers with Tapping Transformers (1,1.5,3,4.5,6W), EN54 Compliant.		No.		
ii		6W Surface mounted Speakers with Tapping Transformers (1,1.5,3,4.5,6W) and surface mounted boxes, EN54 Compliant.		No.		
e)		Installation, testing & commissioning, Programming by Manufacturer Authorized Agent / Dealer and handing over complete PA System to Owner with providing training, SOP, complete equipment's manual and warranty documents to Owners representative.		Job.		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;</b>						



**BILL OF QUANTITIES**

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
<b>4</b>		<b>PUBLIC ADDRESS / BACKGROUND MUSIC SYSTEM FOR SEMINAR HALL</b>				
a)		Supply, installation, testing and commissioning of 180W Line Array Speakers with 8 ohm rated impedance and matching transformer along with mounting bracket as per drawing and specification, complete in all respect.		No.		
b)		Supply, installation, testing and commissioning of Digital stereo mixer with frequency response from 20 to 20 KHz with ARC, FBS and ACG signal processing functions along with mounting bracket as per drawing and specification, complete in all respect.		No.		
c)		Supply, installation, testing and commissioning of gooseneck electret condenser microphone with base stand as per drawing and specification, complete in all respect.		No.		
d)		Supply, installation, testing and commissioning of dual channel power amplifier (2x250W) with 50 to 20 KHz frequency response and matching transformer as per drawing and specification, complete in all respect.		No.		
e)		Supply, installation, testing and commissioning of UHF Wireless microphone with 576 to 937 UHF frequency range with built in antenna as per drawing and specification, complete in all respect.		No.		
f)		Supply, installation, testing and commissioning of UHF Wireless tuner with 64 selectable frequencies and external antenna input as per drawing and specification, complete in all respect.		No.		
g)		Providing, laying, testing and commissioning of 2C - 1.5 Sq.mm PVC cable in 25 mm dia PVC conduit, as per drawing and specification. Complete in all respect.		Job		
h)		19" 12U Rack, Glass Door Imported, lock & keys		No.		
j)		Complete testing & commissioning, software end-user training with 1 years free services.		Job		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;</b>						

**BILL OF QUANTITIES**

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
<b>5</b>		<b>ACCESS CONTROL SYSTEM</b>				
a)		Supply, installing, testing and commissioning of 2 Door Controller LAN Based with power supply, as per drawings and specification, complete in all respect.		No.		
b)		Supply, installing, testing and commissioning of BIO Proximity Card Reader, as per drawings and specification, complete in all respect.		No.		
c)		Supply, installing, testing and commissioning of Exit Control Push Button, as per drawings and specification, complete in all respect.		No.		
d)		Supply, installing, testing and commissioning of Electromagnetic Door Lock with matching power supply, as per drawings and specification, complete in all respect.		No.		
e)		Supply, installing, testing and commissioning of PVC Card for Reader, as per drawing and specifications, complete in all respect.		Nos.		
f)		Installation, testing, commissioning & programming by Manufacturer Authorized Agent / Dealer and handing over complete Access Control System to Owner with providing training, SOP, complete equipment's manual and warranty documents to Owner's Representative.		Job.		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;</b>						

BILL OF QUANTITIES

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
6		<b>CCTV SYSTEM</b>				
a)		Supply, installing, testing and commissioning of 2 MP IP based camera with 1/2.8" CMOS 3.3 to 12mm varfocal lens, power adopter, wall mounted bracket, and IP-65 housing, complete in all respect with fixing accessories, as per drawing and specifications, complete in all respect.		Nos.		
b)		Supply, installing, testing and commissioning of 2 MP IP based indoor Dome camera with 1/2.8" CMOS 3.3 to 9mm varfocal lens, power adopter, complete in all respect with fixing accessories and bracket assembly, as per drawing and specifications, complete in all respect.		Nos.		
c)		Installation, testing, commissioning, programming by Manufacturer Authorized Agent / Dealer and handing over complete CCTV System to Owner with providing training, SOP, complete equipment's manual and warranty documents to owners representative.		Job.		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;</b>						

**BILL OF QUANTITIES**

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
7		<b>ADDRESSABLE FIRE ALARM SYSTEM</b>				
a)		Providing, laying, testing and commissioning of Wiring for complete Fire Alarm System with 2C-1.5 Sq.mm shielded, twisted pair Fire Resistant Cable in 25 mm dia PVC conduit concealed, (M.S conduit for surface) etc., including any wiring between fire alarm control panel and other's systems control panel's etc. Complete in all respect. <b>(Cabling on HOLD, only conduiting in Contractor's Scope)</b>	910	Mtr.		
b)		Providing, installation, testing and commissioning of Addressable Photoelectric Smoke Detector with base and back box, as per drawing and specification, complete in all respect.		Nos.		
c)		Providing, installation, testing and commissioning of Addressable Heat Detector with base and back box, as per drawing and specification, complete in all respect.		Nos.		
d)		Providing, installation, testing and commissioning of Addressable Manual Call Point with base and back box, as per drawing and specification, complete in all respect.		Nos.		
e)		Providing, installation, testing and commissioning of Addressable Manual Call Point (Weatherproof) with base and back box, as per drawing and specification, complete in all respect.		No.		
f)		Providing, installation, testing and commissioning of Addressable Sounder with flasher and base and back box, as per drawing and specification, complete in all respect.		Nos.		
g)		Providing, installation, testing and commissioning of Addressable Sounder (Weatherproof) with flasher, base and back box, as per drawing and specification, complete in all respect.		Nos.		
h)		Providing, installation, testing and commissioning of 02 Loop Addressable Fire Alarm Control Panel (FACP), including all necessary accessories, identification tagging etc. and battery back up. FACP as per drawing and specification, complete in all respect.		No.		
j)		Installation, testing and commissioning, Softwear, Programming by Manufacturer Authorized Agent / Dealer and handing over complete Fire Alarm system to owner with providing training, SOP, complete equipment's manual and warranty documents to Owner's Representative.		Job.		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;&gt;</b>						

**BILL OF QUANTITIES**

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
<b>8</b>		<b>SELF CONTAINED EMERGENCY LIGHTS</b>				
a)		Supply, installing, testing and commissioning of following items for self contained emergency lights with all fixing accessories as per drawing and specification, complete in all respect.				
i		7W, Emergency light with self contained Battery, Surface / Wall mounted IP-20 as per specification and drawing complete in all respect. (non-maintained)	67	Nos.		
ii		7W, Emergency light with self contained Battery, Ceiling mounted IP-20 as per specification and drawing complete in all respect. (non-maintained)	21	Nos.		
iii		7W, Emergency light with self contained Battery, Surface / Wall mounted IP-65 as per specification and drawing complete in all respect. (non-maintained)	25	Nos.		
iv		7W, EXIT light with self contained Battery, 40m viewing, Surface mounted IP-20 as per specification and drawing complete in all respect. (non-maintained)	54	Nos.		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;&gt;</b>						

**BILL OF QUANTITIES**

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
9		<b>CABLE TRAY</b>				
a)		Providing and Installing of following size of base perforated for ELV System, Fabricated with 14/16 SWG MS Sheet steel Hot dip Galvanized including all installation accessories (Hot Dip Galvanized) such as appropriate sizes and lengths of M.S Rod / Angle Iron Supports and Rawl Bolts etc. Complete in all respect as shown in drawings and specification or as directed by the Engineer.				
i		150 x 50mm 16 SWG	200	Mtr.		
ii		300 x 50mm 16 SWG	45	Mtr.		
CARRIED TO ELV SUMMARY =====>>>						

# **PLUMBING WORK**

S. NO.	DESCRIPTION	TOTAL AMOUNT IN PAK RUPEES
<b>A. SCHEDULE ITEMS</b>		
1	Plumbing Fixtures	950,119
2	Sanitary Sewage	306,000
3	Manholes & Gully traps	174,420
	<b>SUB-TOTAL-A Rs.</b>	<b>1,430,539</b>
	_____ % Above/below on Plumbing Works of PWD-2012	
	<b>TOTAL-A Rs.</b>	
<b>B. NON-SCHEDULE ITEMS</b>		
1	Water Supply	
2	Sanitary Sewage	
3	Fire Fighting Works	
	<b>SUB-TOTAL-B Rs.</b>	
	<b>TOTAL AMOUNT (A+B) FOR 1 No.</b>	



Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
1	301-1	<p><b>PLUMBING FIXTURES:</b></p> <p>Providing and fixing best quality squatting type glazed earthward W.C.Pan, Pakistan (of not less than 18" clear opening as measured between the flushing rim) Complete with and including the cost of 13.6 liters best quality low level plastic flushing cistern with internal fittings complete, P.V.C. flushing pipe suitable for this type with fittings and making requisite number of holes in walls, plinth &amp; floor for pipe connections and making good in cement concrete 1:2:4.</p>	27	Nos.	3,425	92,475
2	301-6	<p>Providing and fixing Pakistani make best available quality European style white glazed earthenware wash down W.C.Pan complete with and including the cost of a plastic seat (PVC cover and buffers 3 galls. (13.6 liters) white glazed earthenware low level flushing cistern with siphon fittings, 1-1/2 inches (40mm) dia white porcelain enameled flush bend, 3/4 inch (20mm) dia, G.I. warning pipe carried outside and bent vertically downwards and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4</p>	32	Nos.	4,805	153,760
3	301-7	<p>Providing and fixing Pakistani make flat back lipid front urinal basin (of not less than 17 inches or 430 mm in height of white glazed earthenware complete with and including the cost of one gallon (4.5 liters) glazed earthen ware automatic flushing cistern with fittings a pet cock brackets standard flush pipe with fittings, standard waste pipe (enameled iron) connection complete and making requisite number of holes in walls plinth and floor for pipe connections and making good in cement concrete 1:2:4</p>	9	Nos.	2,804	25,236
4	301-8 & 10 & 14	<p>Providing and fixing 25 inches x 18 inches (635 mm x 457 mm) lavatory basin in white glazed earthenware (Pakistani) complete with and including the cost of Brass oxidized bolts kit built into wall 1/2 inch (15 mm) dia. Chrome plated mixer 1-1/4" inches (32mm) rubber plug and chrome plated brass chain, 1-1/4 inches (32 mm) dia brass waste of approved pattern, 1-1/4 inches (32 mm) dia. Malleable iron or C.P. brass traps malleable iron or brass unions and making requisite number of holes in walls plinth and floor for pipe connections and making good in cement concrete 1:2:4</p> <p>Extra over item No. 8 and 9 (Wasg basin) for providing and fixing best available (Pakistani make) white glazed earthenware pedestal..</p> <p>Extra over item No.8 and 9 for providing single hole chromium plated mixer tap 1/2 inch (15 mm) dia (English or approved foreign make).</p>	50	Nos.	7,225	361,250
<b>Continued..</b>						

Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
		<b><u>PLUMBING FIXTURES (Cont....)</u></b>				
5	301-13	Providing and fixing Shower tray made of fiber glass of any color and design 31 inches x 31 inches (787 mm x 787 mm).	0	Nos.	2,394	-
6	301-20	Providing and fixing standing wall shower of CP brass 3 knobs of approved quality mixer unit and moveable shower head complete..	0	Nos.	4,590	-
7	301-21	Providing and fixing approved quality stainless steel sink 60" x 20" Pak made (Atlas) complete with brass oxidized bolt kit/angle iron brackets built into walls ½" dia CP sink mixer 1-1/4" rubber plug and CP brass chain 1-1/4" CP brass waste 1-1/4" dia malleable iron or CP brass bottle trap with malleable iron or brass unions and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4	2	Nos.	18,677	37,354
8	302-6	Providing and fixing 20 inches x 16 inches (508 mm x 406 mm) Looking mirror of Belgium glass complete with Plastic frame and C.P. Brass screws.	50	Nos.	923	46,150
9	302-9	Providing and fixing bath room accessories of set of 6 pieces consist of one shelf, one towel rod with bracket, one soap dish, one tooth brush holder with glass and cover, one tissue paper holder one double hook one towel ring etc. complete of approved quality as per direction of Engineer in-charge.	15	Nos.	12,757	191,355
10	302-13	Providing and fixing chrome plated Muslim bib-cock without Muslim shower of approved quality	59	Nos.	721	42,539
		<b>CARRIED TO SUMMARY</b>				<b>950,119</b>

Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
1	306-27/28	<p><b><u>SANITARY SEWAGE:</u></b></p> <p>Providing and fixing un plasticized polyvinyl chloride pipe (P.V.C) "D" class and specials etc. including cutting and fitting complete with and including the cost of cutting trench up to 1-1/2 feet deep refilling, watering, ramming, and disposal of surplus earth within one chain and after cleaning the pipe and cartage within 10 miles (16.09 km.) (working pressure 12 kg/cm<sup>2</sup>) 1-1/4 inches (32 mm) dia.</p> <p>(i) 6" dia</p> <p>(ii) 8" dia</p>	600	Rft.	510	306,000
			0	Rft.	712	-
2	315-3	<p><b>Manholes and Gully traps</b></p> <p>Providing manhole Type 'B' size 3'-0" x 2'-6" or 914mm x 762mm x 4ft (1.22mm) deep as per approved design and specifications complete for 4" to 12" diameter pipe, 4 ft. to 7'-5" Depth with cast iron cover and frame weights 1 Cwt. 3 Qtrs or 88.9 kg, in 6" thick RCC 1:2:4 slab 8" thick, c.c. 1:3:6 block masonry walls set in 1:3 c.m. 6" inch thick, 1:3:6, c.c. in foundation 1:2:4 c.c. in benching, 1/2" thick cement plaster in 1:4 c.m. to all inside wall surfaces, channels and benching etc. and top including providing and fixing cast iron foot rest at every foot of depth and making requisite number of main and branch channels complete but excluding that cost of excavation, backfilling, disposal of excavated stuff, manhole cover and frame.</p>	10	Nos.	17,442	174,420
<b>CARRIED TO SUMMARY</b>						<b>480,420</b>

Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
<b>NON-SCHEDULE ITEMS</b>						
		<b>WATER SUPPLY:</b>				
		<b>Cold and Hot Water Supply Piping</b>				
1	Non-Sch	Supply, installation Testing and Commissioning of PPR PN - 20 Cold/Hot water pipes as per DIN 8077-8078 with molded fittings PN - 25 as per DIN 16962, including pipe supports a as indicated on the drawing, as per specifications and Engineers approval.				
i		¾" dia	1,010	Rft		
ii		1" dia	130	Rft		
iii		1¼" dia	260	Rft		
iv		1½ dia	190	Rft		
v		2" dia	420	Rft		
vi		2½ dia	980	Rft		
vii		3" dia	0	Rft		
viii		4" dia	0	Rft		
		<b>Valves</b>				
2	Non-Sch	Providing and fixing of PPR Coated, brass Gate valves (of same material as piping) as indicated on the drawing, as per specifications and Engineers approval.				
i		¾" dia	2	Nos.		
ii		1" dia	2	Nos.		
iii		1¼" dia	4	Nos.		
iv		1½ dia	4	Nos.		
v		2" dia	9	Nos.		
vi		2½ dia	1	Nos.		
vii		3" dia	0	Nos.		
viii		4" dia	0	Nos.		
		<b>Water Tanks and Connection</b>				
3	Non-Sch	Connection for water tank including with valves, supports, excavation and Backfill, complete all in accordance with the drawing and specifications.	1	Item		
4	Non-Sch	2" Connection to RCC water tanks	1	Nos.		
5	Non-Sch	Connection to overhead water tanks using Float switch	1	Nos.		
6	Non-Sch	Cast Iron Medium Duty Cover For RCC water tanks	2	Nos.		
		<b>Continued..</b>				

Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
		<b>WATER SUPPLY (Cont....)</b>				
		<b>Plumbing Specialties:</b>				
7	Non-Sch	Supply and installation of the following including all fittings, fixings, accessories, etc., as indicated on the drawing, as per Specifications and Engineers approval.				
i		1" Air Relief Valve	1	Nos.		
ii		1¼" dia foot valve	1	Nos.		
iii		2" Y-type Strainer	2	Nos.		
iv		2" Flexible Connector	4	Nos.		
8	Non-Sch	<b>Pumps</b>				
	Non-Sch	Supply and installation of below mentioned Transfer Pump Set including pump foundation, control panel, automatic float switch, wiring, valves, piping, accessories, etc., as indicated on the drawing, as per specifications and Engineers approval.				
i		Transfer Pump (1 duty+1 standby) Flow = 100GPM @ 130ft. head	1	set		
9	Non-Sch	<b>Water Filter</b>				
		Supply and installation of 3 stage UV Water filter having minimum flow rate of 0.5 gpm including valves, piping, accessories, etc., as indicated on the drawing, as per specifications and Engineers approval.	3	Nos.		
10		<b>Water Cooler</b>				
		Supply and installation of Stainless Steel Electric water cooler of below mentioned capacity with two taps, R-22 Refrigeration system, S.Steel Tank safety tested at 10kg/cm <sup>2</sup> (142 p.s.i.) with recommended maximum working pressure of 3kg/cm <sup>2</sup> (42 p.s.i.) including all accessories like Valves, interconnecting piping, Drain tray and drain connection s as indicated in the drawings, as per specifications and engineers approval.				
		WC-01 to 05 (65 GPH)	3	Nos.		
<b>CARRIED TO SUMMARY</b>			<b>Total</b>			

Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
		<b><u>SANITARY SEWAGE:</u></b>				
		<b>Soil, Waste, Vent and Rainwater Pipes</b>				
11	Non-Sch	Providing and fixing, uPVC pipes and fittings as per BS EN 1329 for above ground installations for Soil, Waste, Vent & Rw pipes including cleanout plug, clamps, hanger collars, supports, specials (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval.				
		(i) 2" dia	462	Rft.		
		(ii) 3" dia	702	Rft.		
		(iii) 4" dia	798	Rft.		
		(iv) 6" dia	0	Rft.		
		<b>Drainage Specialties</b>				
12	Non-Sch	Providing and fixing, PVC floor trap with multiple dia inlet and cleanout plug of the approved self cleaning design with S.Steel grating, as indicated on the drawing, as per specifications and Engineers approval.	57	Nos		
13	Non-Sch	Providing and fixing UPVC cowl for vent pipe of the following dia including all accessories complete in all respects.				
		(i) 3" dia	4	Nos		
		(ii) 4" dia	4	Nos		
		(iii) 6" dia	0	Nos		
14	Non-Sch	Providing and fixing, PVC Roof Drains as per specifications and Engineers approval.	4	Nos		
		<b>Continued..</b>				

Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
		<b><u>SANITARY SEWAGE (Cont....)</u></b>				
		<b>Gully traps</b>				
15	Non-Sch	Construction of 18" x 18" Cement Concrete gully trap with 12"x 12" manhole cover as specified and shown on the drawing, as per specifications and Engineers approval.	5	Nos.		
16	Non-Sch	<b>External Connection</b> Connection to external Sewage network, after obtaining approval from local authorities including the cost of excavation, Piping as specified and shown on the drawing, as per specifications and Engineers approval.	1	Job.		
		<b>CARRIED TO SUMMARY</b>	<b>Total</b>			

Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
1		<b>FIRE FIGHTING</b> Supply and installation of below mentioned Portable Fire extinguishers with Wall mount brackets as indicated on the drawings, as per specifications and Engineers Recommendation				
i	Non-Sch	5 Kg CO2 wall mounted fire extinguisher	14	Nos.		
ii	Non-Sch	6 Kg Dry powder wall mounted fire extinguisher	14	Nos.		
iii	Non-Sch	12 Kg Automatic Dry Powder Fire extinguisher.	1	Nos.		
2		<b>Fire Piping</b> Supply, installation, testing and Commissioning of Seamless black steel SCH. 40 pipe as per ASTM A53 grade B with UL/FM Heavy Duty welded fittings, UL/FM Galvanized Supports and handers, supports, painting and coding fire protection system of following sizes.				
i		3" dia	270	Rft		
ii		1 1/4" dia	30	Rft		
3		<b>Fire Valves</b> Supply, installation, testing and Commissioning of UL/FM O.S and Y Ductile Iron Gate Valves with post indicator of Class 300 (UL) with EPDM Seal as per ASTM A536 Grooved or flanged type as required as per drawings, specifications and Engineers Recommendation.				
i		3" dia	1	Nos		
4		<b>Fire Hose Reel and Cabinet</b> Supply, installation, testing and Commissioning of Dual compartment Stainless Steel Fire Hose cabinet (Exposed or recessed type) comprising of below mentioned items with S.Steel lock and handle, as per drawings, specifications and Engineers Recommendation.  1" diameter, 30m high pressure rubber hose reel tested on 30 bar with PRV (Pressure Reducing valve), Gate Valve and inlet lock shield control valve and Adjustable plastic Nozzle for Jet, spray and Shut off. 2 1/2" , 100 ft Long lay flat hose Rack + Multi Jey nozzle 2 1/2" diameter Landing valve Dia UL/FM Approved 6 kg Co2 Extinguisher 5 KG ABC type Dry powder Extinguisher				
			6	Nos		
<b>Sub Total for Non Schedule Items</b>			<b>Total</b>			



# **HVAC WORK**

S. NO.	DESCRIPTION	TOTAL AMOUNT IN PAK RUPEES
1	DX- SPLIT TYPE AIRCONDITIONING UNITS	N/A
2	HVAC FANS	
3	CONDENSATE DRAIN PIPING	
4	DUCT WORKS & FLEXIBLE CONNECTOR	
5	AIR DEVICES	
6	HANGER & SUPPORTS	
7	CIVIL WORKS	
8	GENERAL MECHANICAL ITEMS	
<b>GRAND TOTAL SUMMARY</b>		

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6=(3X5)
1	<p><b>DX- SPLIT TYPE AIRCONDITIONING UNITS</b> Supply, Installation, Testing &amp; Commissioning of DX Split Air-conditioning Units, complete refrigerant piping, insulation, cladding, refrigerant tray, cable tray &amp; accessories. Indoor unit with all sections and components given in the schedule and specifications of DX Split Air-conditioning Units, including uplifting / lowering, loading / unloading at site, complete in all respect and as directed by the Engineer incharge in following sizes and capacities.</p> <p><b>GROUND FLOOR</b></p> <p>i DX-01 to 10 /CU-01 to 10 (1.0 TR Capacity Wall Mounted Type)</p> <p>ii DX-11/CU-11 (1.5 TR Capacity Wall Mounted Type)</p> <p>iii DX-12 to 19/CU-12 to 19 (1.0 TR Capacity Wall Mounted Type)</p> <p>iv DX-20 to 27/CU-20 to 27 (1.5 TR Capacity Wall Mounted Type)</p> <p>v DX-28 /CU-28 (1.0 TR Capacity Wall Mounted Type)</p> <p>vi DX-29 /CU-29 (1.5 TR Capacity Wall Mounted Type)</p> <p>vii CTU-01 to 08 /ODU-01 to 08 (2.0 TR Capacity Cassette Type)</p> <p>viii DX-30~31 /CU-30~31 (2.0 TR Capacity Wall Mounted Type)</p> <p><b>FIRST FLOOR</b></p> <p>i DX-01~06 /CU-01~06 (2.0 TR Capacity Wall Mounted Type)</p> <p>ii DX-07,09 &amp;11 /CU-07,09 &amp;11 (1.0 TR Capacity Wall Mounted Type)</p> <p>iii DX-08,10~14 /CU-08,10~14(1.5 TR Capacity Wall Mounted Type)</p> <p>iv DX-15~19 /CU-15~19 (1.0 TR Capacity Wall Mounted Type)</p> <p>v DX-20~22 /CU-20~22 (1.5 TR Capacity Wall Mounted Type)</p> <p>vi DX-23~28 /CU-23~28 (2.0 TR Capacity Wall Mounted Type)</p> <p><b>SECOND FLOOR</b></p> <p>i DX-01~06 /CU-01~06 (2.0 TR Capacity Wall Mounted Type)</p> <p>ii DX-07~21 /CU-07~21 (1.5 TR Capacity Wall Mounted Type)</p> <p>iii DX-22 /CU-22 (1.0 TR Capacity Wall Mounted Type)</p> <p>iv DX-23~25 /CU-23~25 (1.5 TR Capacity Wall Mounted Type)</p> <p>v DX-26~31 /CU-26~31 (2.0 TR Capacity Wall Mounted Type)</p> <p><b>ROOF</b></p> <p>i DX-01 /CU-01 (1.5 TR Capacity Wall Mounted Type)</p>				
<b>AMOUNT CARRIED TO HVAC SUMMARY</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6=(3X5)
2	<b>HVAC FANS</b> Supply, installation, testing and commissioning of HVAC fans, as per equipment schedule, as shown on the drawings including all labour, material and accessories, complete in all respect and to the satisfaction of engineer incharge.				
	<b>GROUND FLOOR</b>				
i	EF-01 ( 200 cfm)	1	Nos.		
ii	EF-02 & 03 (100 cfm)	2	Nos.		
iii	EF-04~6( 200 cfm)	3	Nos.		
iv	EF-07( 100 cfm)	1	Nos.		
v	EF-08( 350 cfm)	1	Nos.		
	<b>FIRST FLOOR</b>				
i	EF-01 ( 200 cfm)	1	Nos.		
ii	EF-02 (100 cfm)	1	Nos.		
iii	EF-03 ( 420 cfm)	1	Nos.		
iv	EF-04(100 cfm)	1	Nos.		
v	EF-05 (200 cfm)	1	Nos.		
vi	EF-06 (100 cfm)	1	Nos.		
vii	EF-07 (280 cfm)	1	Nos.		
viii	EF-08 (100 cfm)	1	Nos.		
	<b>SECOND FLOOR</b>				
i	EF-01 ( 200 cfm)	1	Nos.		
ii	EF-02 (100 cfm)	1	Nos.		
iii	EF-03 ( 420 cfm)	1	Nos.		
iv	EF-04(100 cfm)	1	Nos.		
v	EF-05 (200 cfm)	1	Nos.		
vi	EF-06 (100 cfm)	1	Nos.		
vii	EF-07 (280 cfm)	1	Nos.		
viii	EF-08 (100 cfm)	1	Nos.		
<b>AMOUNT CARRIED TO HVAC SUMMARY</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6=(3X5)
3	<b>CONDENSATE PIPING</b> Providing and fixing, uPVC Class 'E' pipes and fittings as per BS 3505 (EN 1401) for Condenser Water drainage including fittings, bends, cuttings, filling etc. as indicated on drawings, as per specifications and Engineers approval.				
i	1" dia	1560	Rft		
ii	1 1/4" dia	430	Rft		
iii	1 1/2" dia	120	Rft		
<b>AMOUNT CARRIED TO HVAC SUMMARY</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6=(3X5)
4	<b>DUCT WORKS</b> Supply, fabrication, installation, testing and commissioning of Sheet Metal hand made / machine fabricated Duct Work as shown on the drawings and as per technical specification including all labour, material, accessories, tees, plenum, transition pieces, splitter dampers, special duct test holes, duct access doors, air deflector, as where required complete in respect and to the satisfaction of Engineer incharge. i 24 - Gauge	150	Sq.Ft		
5	<b>FLEXIBLE DUCT CONNECTOR</b> Supply and installation of rubber impregnated canvas Flexible Duct Connector (imported type) between Fans all other equipment and Duct Work as shown on the drawings including all labour, material, accessories, complete in respect and to the satisfaction of engineer incharge.	2	Nos.		
<b>AMOUNT CARRIED TO HVAC SUMMARY</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6=(3X5)
6	<p><b>AIR DEVICES</b> Supply, installation, Testing &amp; Commissioning of Air Devices included with back opposed blade volume controller with accessible key operator, as shown on the drawings and as specified in technical specifications including balancing of air flow rates, including all labour, material and accessories, complete in all respect and as directed by the Engineer incharge.</p> <p><b>Exhaust Air Diffuser with Damper</b></p> <p>i 6" x 6" 6 Nos</p> <p>ii <b>Exhaust Air Louver</b> 18" x 6" 1 Nos 8" x 6" 1 Nos</p>				
<b>AMOUNT CARRIED TO HVAC SUMMARY</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6=(3X5)
7	<p><b>HANGER &amp; SUPPORTS</b> Supply, installation, testing and commissioning of Galvanized Hanger and Supports for piping, ducting, all HVAC Equipments, as shown on the drawings and as specified in technical specification, complete with angle iron, rawal bolts, threading rods, nuts and bolts, wooden pieces, including the cost of cleaning, painting with corrosion resistant paint, jointing and welding, including all labour, material and accessories, complete in all respect and to the satisfaction of Engineer Incharge.</p>	1	Lot		
<b>AMOUNT CARRIED TO HVAC SUMMARY</b>					



S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6=(3X5)
8	<p><b>CIVIL WORKS</b> Making and cutting in walls, slabs and preparation of RCC foundation for Condensing Unit, Fans and all other HVAC equipments in all other work such as Openings, Penetrations, Firestopping, Acoustic Cork sheet, Wooden Frame Sleeves and Pipe Sleeves, plaster finish etc as directed by Engineer Incharge, complete in all respect.</p>	1	Job		
<b>AMOUNT CARRIED TO HVAC SUMMARY</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6=(3X5)
9	<b>GENERAL MECHANICAL ITEMS</b>				
i	<b>SHOP DRAWINGS &amp; AS BUILT DRAWINGS</b> Providing Shop Drawings and As Built Drawings in A1 size, as advised by the Consultant, complete in all respect.	1	Job		
ii	<b>PAINTING &amp; FINISHES</b> Providing Painting and Finishing,as directed by the Engineer Incharge, complete in all respect.	1	Job		
<b>AMOUNT CARRIED TO HVAC SUMMARY</b>					

# **MASTER SUMMARY**

S.No	Description	Amount
1	Faculty Block (Media Sciences)	
2	Faculty Block (Natural/Basic Sciences)	
<b>TOTAL COST OF LOT-1</b>		-

**FACULTY BLOCK OF**  
**MEDIA SCIENCES**

S.No	Description	Amount
A	PRELIMINARIES & GENERAL REQUIREMENTS	<i>Included in Permanent works</i>
B	PERMENANT Works	
1	CIVIL WORKS	
2	ELECTRICAL WORKS	
3	ELV WORKS	
4	PLUMBING WORKS	
5	HVAC WORKS	
<b>TOTAL COST</b>		-

# **CIVIL WORK**

## BILL OF QUANTITIES

S.No	Description	Amount
<b>A</b>	<b>SCHEDULE ITEM</b>	
1	EARTH WORKS	1,660,680
2	SUB STRUCTURE	29,035,125
3	SUPER STRUCTURE	48,046,641
4	MASONRY WORKS	11,535,088
5	THERMAL & MOISTURE PROTECTION	864,630
6	METAL WORKS	5,845,788
7	WOOD WORKS	3,534,266
8	FLOOR FINISHES	8,534,945
9	WALL FINISHES	10,339,387
10	CEILING FINISHES	2,540,911
11	EXTERNAL FINISHES (BUILDING)	4,309,052
12	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	1,769,668
	<b>Total of Schedule Items - A</b>	<b>128,016,181</b>
	_____ % Above/below on Civil Works of PWD-2012	
	<b>Total of Schedule Items - A</b>	
<b>B</b>	<b>NON-SCHEDULE ITEM</b>	
1	EARTH WORKS	
2	SUB STRUCTURE	
3	SUPER STRUCTURE	
4	MASONRY WORKS	
5	THERMAL & MOISTURE PROTECTION	
6	METAL WORKS	
7	WOOD WORKS	
8	FLOOR FINISHES	
9	WALL FINISHES	
10	CEILING FINISHES	
11	EXTERNAL FINISHES (BUILDING)	
12	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	
	<b>Total of Non-Schedule Items - B</b>	
	<b>TOTAL CARRIED TO GRAND SUMMARY (A+B)</b>	



S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4		6	7 = 4 x 6
<b>SCHEDULE ITEMS</b>						
1		<b><u>EARTH WORKS</u></b>				
1.1	Code -103,	Excavation for foundations trenches, drains, underground tanks and septic tanks in <b>gravelly soil</b> (medium dense to very dense fine to coarse grained sandy gravel) and back filling the excavated material in foundation, plinth or under floor including breaking clods, watering, consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction, dressing and disposal of surplus excavated stuff as directed, lead up to one chain (30.5 R.m) and lift up to 5 feet (1.52 m) etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 2	From ± 0'-0" to -5' - 0"	66361 Cft	100 Cft	613.14	406,886
	Item # 2+28	From -5' - 0" to -8' - 0"	2687 Cft	100 Cft	690.49	18,553
	Item # 2+28+28	From -8' - 0" to -11' - 0"	1120 Cft	100 Cft	767.84	8,600
1.2	Code -104 Item #8	Supplying earth from approved outside sources within a radius of 5 miles (8 km) including digging, loading and unloading and filling in foundations trenches plinth or under floor, etc. including breaking clods, dressing, watering and consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction complete within a lead of one chain (30.5 R.m) and lift of 5 feet (1.52mm) etc. complete, including all lifts etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	29968 Cft	100 Cft	2,467.50	739,460
1.3	Code -117 Item #1	Providing and laying soling stones 6 inches to 9 inches (152 mm to 229 mm) size under floors/foundations & where required etc. including packing with sprawls and chips and consolidating etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	14984 Cft	100 Cft	3,251.34	487,181
<b>Total Carried to Summary</b>						<b>1,660,680</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
<b>2</b>		<b>SUB STRUCTURE</b> <b>Note: All RCC Concrete will be used only Ready mixed.</b>				
		<b>CONCRETE WORKS</b>				
2.1	Code -106	Providing and laying in situ <b>1:4:8</b> (1 cement 4 sand and 8 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 11	Below plinth beam,situ,walls,tanks, over stone soling or where required <b>(Cylindrical 1000 Psi)</b>	11824 Cft	100 Cft	14,411.43	1,704,007
2.2	Code -106	Providing and laying in situ <b>1:3:6</b> (1 cement 3 sand and 6 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work, etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 12	For Cast in situ / mass concrete or where required <b>(Cylindrical 1500 Psi)</b>	687 Cft	100 Cft	15,840.97	108,827
2.3	Code -114	<b>REINFORCED CONCRETE WORKS</b> Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N/mm <sup>2</sup> at 28 days) with a mix not leaner than 1:2:4 in columns footing of required shape with columns and pillars, of any shape including form work and its removal, compacting, leveling and curing etc. complete but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 1+136	Foundation for any type <b>(Cylindrical Strength 2500 Psi)</b>	48467 Cft	100 Cft	17,514.88	8,488,937
<b>Total Carried to Collection</b>						<b>10,301,771</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>4500 lbs. per sq. inch</b> (31.04 N/mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:1:2</b> in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth. etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 4+135+138	Columns upto plinth <b>(Cylindrical Strength 4000 Psi)</b>	1997 Cft	100 Cft	26,704.50	533,289
2.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>4500 lbs. per sq. inch</b> (31.04 N/mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:1:2</b> in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 9+135+138	RCC Wall/Shear Wall upto plinth <b>(Cylindrical Strength 4000 Psi)</b>	78 Cft	100 Cft	27,958.39	21,808
2.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in plinth beams of required shape and design including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 8+136	Plinth Beams i/c nibs / projections <b>(Cylindrical Strength 2500 Psi)</b>	5222 Cft	100 Cft	18,172.93	948,990
<b>Total Carried to Collection</b>						<b>1,504,087</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in foundation or bottom slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 99+136	UGWTank Bottom Slab <b>(Cylindrical Strength 2500 Psi)</b>	628 Cft	100 Cft	15,182.84	95,348
2.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in top slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 104+136	UGWTank Top Slab <b>(Cylindrical Strength 2500 Psi)</b>	157 Cft	100 Cft	20,471.59	32,140
2.9	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in walls of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 101+136	UGWTank Walls <b>(Cylindrical Strength 2500 Psi)</b>	349 Cft	100 Cft	20,782.39	72,531
<b>Total Carried to Collection</b>						<b>200,019</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.10	Code -114 Item # 166	Providing and laying hard grade ribbed deformed <b>(minimum yield point 60,000 psi or 414 Mpa)</b> reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <b>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</b>	135730 Kg	Kg	123.02	16,697,505
2.11	Code -124 Item # 93	Providing and fixing plain polyvinyl chloride (PVC) water stops 12" (305 mm) wide in vertical or horizontal expansion joints including cutting and jointing complete in all floors etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	111 Rft	Rft	500.16	55,518
2.12	Code -108 Item # 12	Providing a coat of <b>bitumen emulsion at 10 Lbs. per % sft. (0.49 Kg/sm)</b> on walls and floor in ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	42622 Sft	100 Sft	648.08	276,225
<b>Total Carried to Collection</b>						<b>17,029,248</b>
<b>COLLECTION</b>						
		Page No -2				10,301,771
		Page No -3				1,504,087
		Page No -4				200,019
		Total from this Page				17,029,248
<b>Total Carried to Summary</b>						<b>29,035,125</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
<b>NON-SCHEDULE ITEMS</b>						
<b>SUB STRUCTURE</b>						
<b>TERMITE PROOFING</b>						
2.13		<p>Termite control treatment of sub grade soil, excavated surfaces and fill material with HEPTACHLOR emulsifiable to 0.5% with clean water or AGENDA 25 EC containing FIPRONIL or BIFLEX with Bifenthrin or DURSBIN or TENEKIL PLUS or MIRAGE ALI AKBER GROUP or approved equivalent as per manufacturer's specifications and instructions. etc., complete in all respects as per drawing, standard , specifications and as directed by the Engineer.</p> <p><b>(Note: Plinth Area will be measured one time for payment where is the number of applications will be three times on all horizontal &amp; vertical surfaces of the excavation for termite proofing)</b></p>	26056 Sft	Sft		
<b>Total Carried to Summary</b>						

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
<b>3</b>		<b><u>SUPER STRUCTURE</u></b> <b>Note: All RCC Concrete will be used only Ready mixed.</b>				
		<b>REINFORCED CONCRETE WORKS</b>				
3.1	Code -114 Item # 4+135+138	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>4500 lbs. per sq. inch</b> (31.04 N/mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:1:2</b> in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in the ground floor etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.				
		<b>Columns (Cylindrical Strength 4000 Psi)</b>				
	Item # 24+135+138	Ground Floor	6441 Cft	100 Cft	30,389.36	1,957,379
	Item # 24+135+138+92	First Floor	4477 Cft	100 Cft	31,338.56	1,403,027
	Item # 24+135+138+92+93	Second Floor	4375 Cft	100 Cft	32,090.01	1,403,938
	Item # 24+135+138+92+93+93	Roof	461 Cft	100 Cft	32,841.46	151,399
3.2	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>4500 lbs. per sq. inch</b> (31.04 N/mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:1:2</b> in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.				
		<b>RCC Wall / Shear Wall (Cylindrical Strength 4000 Psi)</b>				
	Item # 30+135+138	Ground Floor	364 Cft	100 Cft	28,692.59	104,441
	Item # 30+135+138+92	First Floor	395 Cft	100 Cft	29,641.79	117,085
	Item # 30+135+138+92+93	Second Floor	395 Cft	100 Cft	30,393.24	120,053
<b>Total Carried to Collection</b>						<b>5,257,322</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.3	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in straight beams lintels cantilever beams of required shape or section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.  Beams /Arches/ purdi / bracing / lintels / nibs / sills / coping / parapet wall /bands/around opening and projections <b>(Cylindrical Strength 2500 Psi)</b>				
	Item # 38+136	Ground Floor	3699 Cft	100 Cft	20,668.60	764,532
	Item # 38+136+92	First Floor	5651 Cft	100 Cft	21,617.80	1,221,622
	Item # 38+136+92+93	Second Floor	4880 Cft	100 Cft	22,369.25	1,091,619
	Item # 38+136+92+93+93	Roof	353 Cft	100 Cft	23,120.70	81,616
3.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in ordinary slab more than 6 inches (152 mm) thick including form work and its removal compacting and curing etc. complete but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.  Slab i/c projections <b>(Cylindrical Strength 2500 Psi)</b>				
	Item # 57+136	Ground Floor	11245 Cft	100 Cft	19,520.67	2,195,099
	Item # 57+136+92	First Floor	12368 Cft	100 Cft	20,469.87	2,531,714
	Item # 57+136+92+93	Second Floor	11043 Cft	100 Cft	21,221.32	2,343,470
	Item # 57+136+92+93+93	Roof	1023 Cft	100 Cft	21,972.77	224,781
<b>Total Carried to Collection</b>						<b>10,454,453</b>



S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in straight stairs and landing of required section including form work and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in basement plinth and ground floor.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
		Stair Case / steps /seats (Steps, Landing & Waist slab) <b>(Cylindrical Strength 2500 Psi)</b>				
	Item # 50+136	Ground Floor	2382 Cft	100 Cft	25,989.63	619,073
	Item # 50+136+92	First Floor	737 Cft	100 Cft	26,938.83	198,539
	Item # 50+136+92+93	Second Floor	190 Cft	100 Cft	27,690.28	52,612
3.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in a square of rectangular bottom slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement .etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 114+136+(127x2),	OH Water Tank Bottom Slab <b>(Cylindrical Strength 2500 Psi)</b>	149 Cft	100 Cft	26,609.81	39,649
3.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in straight walls in over head water tank bins, bunkers, intze tanks and silo up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 112+136+(127x2),	OH Water Tank Walls <b>(Cylindrical Strength 2500 Psi)</b>	268 Cft	100 Cft	27,185.58	72,857
<b>Total Carried to Collection</b>						<b>982,730</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of <b>3000 lbs. per sq. inch</b> (20.69 N /mm <sup>2</sup> at 28 days) with a mix not leaner than <b>1:2:4</b> in roof slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
3.9	Item # 118+136+(127x2), Code -114	OH Water Tank Top Slab <b>(Cylindrical Strength 2500 Psi)</b> Providing and laying hard grade ribbed deformed <b>(minimum yield point 60,000 psi or 414 Mpa)</b> reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <b>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</b>	104 Cft	100 Cft	24,213.37	25,182
	Item # 166	Ground Floor	88466 Kg	Kg	123.02	10,883,087
	Item # 166+174	First Floor	82046 Kg	Kg	124.47	10,212,266
	Item # 166+174+175	Second Floor	73018 Kg	Kg	125.92	9,194,427
	Item # 166+174+175 +175	Roof	8143 Kg	Kg	127.37	1,037,174
<b>Total Carried to Collection</b>						<b>31,352,136</b>
<b>COLLECTION</b>						
		Page No -7				5,257,322
		Page No -8				10,454,453
		Page No -9				982,730
		Total from this Page				31,352,136
<b>Total Carried to Summary</b>						<b>48,046,641</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
<b>A - SCHEDULE ITEMS</b>						
<b>4</b>		<b>DPC &amp; MASONRY WORKS</b>				
		<b>Damp Proof Course (DPC)</b>				
4.1	Item # 3 Code -108 Page # 47	Providing and laying 2 inches (51 mm) thick damp proof course with cement concrete 1:2:4 cast in situ using graded screened bajri of 3/4 inch (19 mm) and down gauge mixed with any approved water proofing agent including compacting, curing form work and its removal etc. complete, but excluding the cost of water proofing agent .etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. 2" thick DPC	1826 Sft	100 Sft	2,659.79	48,568
4.2	Item # 5 Code -108 Page # 47	Extra for using water proofing agent pudlo in item Nos. 4.1 (quantity to be used as per manufacturer's specification/2.50Kg per 100Sft).etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	48 Kg	Kg	86.10	4,133
		<b>Block Masonry (Hollow &amp; Solids)</b>				
4.3	Code-111 Page # 87 & 82	Providing and laying 1:3:6 cement concrete <b>hollow block masonry</b> of any thickness using graded screened bajri 1/2 inch (13 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking, out Joints and curing etc. complete in basement and ground floor superstructure.				
	Item # 1+12+18+19	Ground Floor	7942 Cft	100 Cft	13,779.44	1,094,363
	Item # 1+9+12+18+19	First Floor	7794 Cft	100 Cft	14,338.43	1,117,537
	Item # 1+9+10+12+18+19	Second Floor	7583 Cft	100 Cft	14,722.11	1,116,378
	Item # 1+9+10+10+12+ 18+19	Roof	4263 Cft	100 Cft	15,105.79	643,960
4.4	Code-110 Page # 77, 80, 81 & 82	Providing and laying 1:3:6 machine made standard size 4"x8"x12" & 6"x8"x12" cement concrete solid block masonry <b>4 to 6 inches (102 mm to 152 mm)</b> thick using graded screened bajri 3/4 inch (19 mm) and down gauge set in <b>cement mortar 1:6</b> including scaffolding, raking out joints and curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item #44+92+100	Ground Floor	10392 Cft	100 Cft	15,933.28	1,655,786
	Item # 44+92+100+70	First Floor	10392 Cft	100 Cft	16,757.05	1,741,393
	Item # 34+92+100+70+71	Second Floor	10392 Cft	100 Cft	16,579.03	1,722,893
	Item # 44+92+100+70+71 +71	Roof	11336 Cft	100 Cft	18,116.01	2,053,631

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
4.5	Code-110 Page # 76, 80 & 81  Item # 34+92+75+68	Providing and laying 1:3:6 machine made standard size 6"x8"x12" cement concrete solid block masonry <b>more than 6 inches (152 mm) thick in steps, stairs</b> of approved design using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking out joints and curing etc. complete in ground floor superstructure etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.  FOR BLOCK MASONRY STEPS	1919 Cft	100 Cft	17,532.37	336,446
<b>Total Carried to Summary</b>						<b>11,535,088</b>
5		<b>THERMAL &amp; MOISTURE PROTECTION</b>				
5.1	Code-108  Item # 25 Page #49	Providing and laying 1:9 cement concrete using screened graded bajri 3/4 inch (19 mm) and down gauge in terracing 3 inches (76 mm) average thickness to required slope in panels including form work, consolidation, finishing, curing etc. and painting the surface with plastic bitumen No. 4 at the rate of 15 lbs per hundred square feet (0.73 Kg per s.m) blinded with sand at the rate of 2 cubic feet per hundred square feet (0.06 Kg per s.m) complete" on ground floor roof.  Second Floor & Above	23879 Sft	100 Sft	3,620.88	864,630
<b>Total Carried to Summary</b>						<b>864,630</b>
6		<b>METAL WORKS</b>				
		<b>M.S. / G.I Door Frame</b>				
6.1	Code -119 Item # 43 Page # 240	Providing and fixing M.S. moulded steel door frame of 4" x 2-1/2" (102 mm x 64 mm) manufactured from mild steel sheet of 18 gauge (1.41 mm) conforming to BSS. 1245 having a single rebate size 1-1/2" x 1/2" (38 mm x 13 mm) with provision of 3 Nos. M.S. plate, section 1-1/2" x 1/4" (38 mm x 6 mm), (2 Nos. 6 inch long welded with frame at not less than 10 points and 1 No., 12 inch long welded with frame at not less than 20 points), with holes and threads for fixing steel hinges, fitted with one locking box of same sheet (point welded inside the frame), 6 Nos. 6 inches long flat iron fixing lugs, of 1-1/4" x 3/16" section, treated with special red oxide primer coat all around including cutting holes and filling the cavity with cement concrete 1:2:4 etc. in any floor at any height. etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	1062 Rft	Rft	157.12	166,861
6.2	Code -122 Item #159 Page # 333	Painting Iron work with <b>synthetic enamel paint</b> of approved make and shade two coats over and including the cost of one priming coat at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	1193 Sft	100 Sft	2,776.62	33,125
6.3	Code -119 Item #69 Page # 244	Providing and fixing double glazed Bronz anodized or Powder Coated aluminium Sliding windows as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan Cables and A.C.P. (fixing through their approved fabricators), Executive model section double or single glazed 101mm x 37mm and 2mm thick including the cost of aluminium netting ,fitting, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	4100 Sft	Sft	683.72	2,803,252

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
6.4	Code -119 Item #60 Page # 242	Providing and fixing fully glazed Bronz anodized or powder coated aluminium Fixed windows Partition as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan cable and A.C.P. (fixing through their approved fabricators) deluxe model box section 101.76mm x 44.50mm and 2mm thick including the cost of aluminium fittings, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	4988 Sft	Sft	330.23	1,647,187
6.5	Code -119 Item #119 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc. including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height.	8640 Sft	Sft	88.91	768,182
6.6	Code -119 Item #53 Page # 242	Providing and fixing G.I. pipe railing of 2" (50 mm) diameter, comprising, vertical posts and horizontal bracing of G.I. pipe of the same dia as per design including cost of specials, bends, threading, cutting and making good the floor or wall of any kind in cement concrete 1:2:4 etc. 'complete in any floor.	1140 Rft	Rft	374.72	427,181
<b>Total Carried to Summary</b>						<b>5,845,788</b>
<b>7</b>		<b><u>WOOD WORKS</u></b>				
7.1	Code-120  Item # 2 Page # 259	<b>Door Frame</b> Providing and fixing best quality deodar frames for doors, windows, ventilators, clerestory windows, shelves, partitions, trellis work, etc., as required .  G.Floor  F.Floor  S.Floor & Roof	46 Cft  42 Cft  56 Cft	Cft  Cft  Cft	4,595.14  4,595.14  4,595.14	211,376  192,996  257,328
7.2	Code-120 Item # 63 Page # 265	<b>Door Shutter</b> Providing and fixing 1-1/2 inches (38 mm) thick pressed veneered door shutters <b>fully flushed with commercial ply wood</b> veneering on all faces and sides fixed over deodar wood cavities core and frame work of not less than 4 inches (102 mm) wide strip around with approved brass hinges and tower bolts etc., as required .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	4128 Sft	Sft	655.18	2,704,583
7.3	Code-122 Item # 189 Page # 336	<b>Polish &amp; Paint</b> Providing & Applying French or spirit polishing, two coat of approved make on wood work at any height in any floor .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.  For Door Frame	4545 Sft	100 Sft	1,878.96	85,399
7.4	Code-122 Item # 156 Page # 333	Painting wood work with super gloss enamel paint of approved make and shade two coats over and including the cost of one coat of priming complete at any height in any floor .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.  Door Shutter	3181 Sft	100 Sft	2,596.16	82,584
<b>Total Carried to Summary</b>						<b>3,534,266</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
8		<b>FLOOR FINISHES</b>				
8.1	Code-117	<b>Mosaic Tiles</b> Providing and laying 1 inch (25 mm) thick floor of <b>mosaic marble chips tiles 12" X 12" X 1"</b> (1/2 inch topping 1/2" base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) <b>in white cement</b> with approved marble chips in ground floor over 1" (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, Jointing and washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 79 Page# 199	Ground Floor	11532 Sft	100 Sft	12,237.02	1,411,173
	Item # 79+94 Page# 199 & 201	First Floor	9327 Sft	100 Sft	12,432.15	1,159,547
	Item # 79+94+95 Page# 199 & 201	Second Floor	9327 Sft	100 Sft	12,564.84	1,171,923
8.2	Code-117 Item # 159 Page# 209	<b>Porcelain Tiles</b> Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding <b>1600 Sqcm</b> each, <b>(Pak made)</b> on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 159 Page# 209	G.Floor	8671 Sft	100 Sft	17,882.39	1,550,582
	Item # 159 Page# 209	First Floor	9064 Sft	100 Sft	17,882.39	1,620,860
	Item # 159 Page# 209	Second Floor	9064 Sft	100 Sft	17,882.39	1,620,860
<b>Total Carried to Summary</b>						<b>8,534,945</b>
9		<b>WALL FINISHES</b>				
9.1	Code-122	<b>Internal Wall Plaster</b> 1/2" (13 mm) thick cement plaster 1:6 on wall columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	60490 Sft	100 Sft	1,730.74	1,046,925
	Item # 6+87 Page # 320 & 327	First Floor	60490 Sft	100 Sft	1,884.61	1,140,001
	Item # 6+87+90 Page # 320, 327 & 328	Second Floor	60490 Sft	100 Sft	2,015.07	1,218,916
	Item # 6+87+90+90 Page # 320, 327 & 328	Roof	761 Sft	100 Sft	2,145.53	16,327

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
9.2	Code-117 Item # 159 Page# 209	<b>Dado &amp; Skirting</b> Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding <b>1600 Sqcm</b> each, <b>(Pak made)</b> on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 159 Page# 209	G.Floor	2450 Sft	100 Sft	17,882.39	438,119
	Item # 159 Page# 209	First Floor	2450 Sft	100 Sft	17,882.39	438,119
	Item # 159 Page# 209	Second Floor	2450 Sft	100 Sft	17,882.39	438,119
9.3	Code-118 Item # 55 + 58 Page# 219	Providing and fixing marble mosaic tile 12" X 6" X 3/4" (305 mm X 152 X 19 mm) with chips No. 0 to 4 in <b>dado and skirting</b> of approved design in light shade over 1 /2 inch (13 mm) thick base of cement mortar 1:3 in ground floor setting of tiles in slurry of grey cement over mortar base including filling of joints and washing the tiles with cement slurry of matching colour curing, grinding, rubbing and polishina etc. complete.				
	Code-118 Item # 55 + 58 Page# 219	G.Floor	1532 Sft	100 Sft	14,274.50	218,685
	Code-118 Item # 55 + 58+60 Page# 219	F.Floor	1233 Sft	100 Sft	14,567.19	179,613
	Code-118 Item # 55 + 58+60+61 Page# 219	S.Floor	1233 Sft	100 Sft	14,813.05	182,645
9.4	Code-122	<b>Puddlo Plaster</b> 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8	U.G.W.T Plaster	550 Sft	100 Sft	2,367.12	13,019
	Item # 8+88	O.H.W.T Plaster	350 Sft	100 Sft	2,572.28	9,003
9.5	Code-122	Providing and mixing water proofing agent pudlo in cement mortar of any description in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 30	U.G.W.T	15 Kg	Kg	86.15	1,292
	Item # 30	O.H.W.T	10 Kg	Kg	86.15	862
9.6	Code-122 Item # 162	Painting with (ICI) Deluxe plastic emulsion paint VIP of approved shade two coats over and including the cost of one priming coat complete over plastered surface at any height in any floor .	182261 Sft	100 Sft	2,742.08	4,997,742
<b>Total Carried to Summary</b>						<b>10,339,387</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
10		<b>CEILING FINISHES</b>				
		<b>Internal Ceiling Plaster</b>				
10.1	Code-122	1/2" (13 mm) thick cement plaster 1:6 on ceilings cantilever soffits others etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	19663 Sft	100 Sft	1,730.74	340,315
	Item # 6+87 Page # 320 & 327	First Floor	22686 Sft	100 Sft	1,884.61	427,543
	Item # 6+87+90 Page # 320, 327 & 328	Second Floor	21098 Sft	100 Sft	2,015.07	425,139
	Page # 320, 327 & 328	Roof	364 Sft	100 Sft	2,145.53	7,810
10.2	Code-122 Item # 151	Distemping with vinyl distemper (ICI) Deluxe Paintex of approved make and shade in two coats over and including the cost of one priming coat of lime wash including sand papering, dusting, and filling the holes, cracks and inequalities, if any, at any height in any floor.	63447 Sft	100 Sft	1,053.54	668,440
10.3	Code-124 Item # 182 Page# 361	Providing and fixing Gypsum board 2' x 2' x 12mm tiles ceiling including Aluminum T & L angle 1" x 1" i.c hanger clips jointing clips and G.I Wire etc. complete as required in any floor.	6403 Sft	Sft	71.69	459,031
10.4	Code-124 Item # 183 Page# 361	Providing and fixing mineral fiber tiles 2' x 2' x 12mm ceiling including T & L angle hanger clips jointing clips and G.I Wire etc. complete as required in any floor.	2744 Sft	Sft	77.49	212,633
<b>Total Carried to Summary</b>						<b>2,540,911</b>
11		<b>EXTERNAL FINISHES</b>				
		<b>External Plaster</b>				
11.1	Code-122	3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8 Page # 320	Ground Floor	5557 Sft	100 Sft	2,367.12	131,541
	Item # 8+88 Page # 320 & 327	First Floor	5557 Sft	100 Sft	2,572.28	142,942
	Item # 8+88+91 Page # 320, 327 & 328	Second Floor	3969 Sft	100 Sft	2,746.22	108,997
	Item # 8+88+91+91 Page # 320, 327 & 328	Roof	5172 Sft	100 Sft	2,920.16	151,031
11.2	Code-122 Item # 83 Page # 327	Extra for providing horizontal or vertical joints or grooves 3/8" x 1/4" (9.5 mm x 6.4 mm) size of approved design over item No. 11.1	5172 Sft	100 Sft	518.48	26,816
11.3	Code-122	Painting three coats with <b>weather shield paint deluxe (ICI)</b> make of approved shade on plaster surface (External) and including the cost of cleaning the surface, sand papering etc. complete at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 172	Ground Floor to Roof	5172 Sft	100 Sft	1,406.88	72,764



S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
11.4	Code-122	Providing and applying <b>colour Crete</b> 1/4" (6.4 mm) 1:1:2 (1 white cement mixed with pigment, 1 marble powder and 2 marble chips zero No.) with horizontal & vertical joints or Grooves including dragging the surface with wire brush complete with curing etc., over base of 3/4" (19 mm) thick cement plaster 1:3 in plinth, mezzanine and ground floor including chiseling the surface to give texture of stone including the cost of base course etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 79+82+83 Page # 326 & 327	Ground Floor	13375 Sft	100 Sft	8,043.11	1,075,766
	Item # 79+82+83+88	First Floor	14051 Sft	100 Sft	8,248.27	1,158,964
	Item # 79+82+83+88+91 Page # 326 & 327	Second Floor	12808 Sft	100 Sft	8,422.21	1,078,717
11.5	Item # 88 Page #149 &150	Providing and fixing 1:2 <b>precast reinforced or plain cement concrete jali</b> or louvers up to 2 inches (51 mm) thick in required shape including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in ground floor (no deduction for holes shall be made)				
	Item # 88	Ground Floor	350 Cft	100 Cft	33,815.30	118,354
	Item # 88+94	First Floor	350 Cft	100 Cft	34,478.61	120,675
	Item # 88+94+95	Second Floor	350 Cft	100 Cft	34,995.59	122,485
<b>Total Carried to Summary</b>						<b>4,309,052</b>
<b>12</b>		<b>EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)</b>				
		<b>C.C 1:2:4 Floor</b>				
12.1	Code-117	Providing and laying floors of 3 inches (76 mm) thick 1:2:4 cement concrete using graded screened bajri 3/4 inch (19 mm) and down gauge in ground floor laid in panels including form work, consolidation, finishing and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the				
	Item # 7	Ground Floor	2569 Sft	100 Sft	4,289.49	110,197
12.2	Code-117 Item # 158 Page# 208	Providing and laying in floor C.C. 1:2:4: <b>tuff pavers 2" thick</b> of approved design and colour and pattern ( <b>average strength 7000 psi</b> ) laid on sand cushion filling of joint with sand and warring etc. complete as per direction of Engineer In charge. (the cost of sand cushion is included) complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
			11690 Sft	Sft	61.64	720,572
		<b>CC Tiles</b>				
12.3	Code-117 Item # 97 Page# 202	Providing and laying floor 1 inch (25 mm) thick of cement tiles 12" X 12" X 1" (1 /2" topping and 1 /2 inch base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in grey cement in ground floor over 1 inch (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, jointing and washing the tiles with neat cement slurry, polishing and curing etc. complete including the cost of mortar. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
			10761 Sft	100 Sft	8,725.02	938,899
<b>Total Carried to Summary</b>						<b>1,769,668</b>

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
<b>NON-SCHEDULE ITEMS</b>						
7		All items under this head (Architectural) to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respects and to the entire satisfaction of the Engineer.				
		<b>WOOD WORKS</b>				
		<b>FIXED GLAZING</b>				
7.1	N.S.I	Providing, fabricating and fixing, fixed glazing including glass partition wall, fully flushed door shutter and MDF partition wall, comprising of 2" x 4" best quality imported OAK wood framing with fixed glass panels & MDF partation including 1-1/2" thick solid core flush door shutter with 5mm thick commercial ply (Oak finished) over rough wood cavities core, inner frame not less than 4 inches (100 mm) wide strip all around hollow area, except framing to be filled with the approved rough wood, 1-1/2" X 5/8" thick solid oak wood edge lipping all around the shutter, with or without fan light and with or without vision panel including termite treatment (using anty termite clear liquid by Jaffar bothers or approver equivalent), using 6mm thick clear glass for glass partition panel & 5mm thick for vision panel all glass by (Pilkington / Emirates glass or approved equivalent & lamination film thickness not less than 100 micron by 3M or approned equivalent ), 3/8" thick MDF either sides etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		DW1	523 Sft	Sft		
		DW2	172 Sft	Sft		
		DW2a	252 Sft	Sft		
		DW3	679 Sft	Sft		
		DW3a	746 Sft	Sft		
		DW4	338 Sft	Sft		
		DW5a	844 Sft	Sft		
		DW5	641 Sft	Sft		
		DW6	315 Sft	Sft		
		DW7	152 Sft	Sft		
		DW8	574 Sft	Sft		
		DW8a	736 Sft	Sft		
		DW9	212 Sft	Sft		
		DW9a	155 Sft	Sft		
		DW10	384 Sft	Sft		
7.2	N.S.I	Providing, fabricating and fixing, fixed glazing including glass partition and MDF partition wall, comprising of 2" x 4" best quality imported OAK wood framing, 6mm thick clear glass by (Pilkington / Emirates glass or approved equivalent) & fixing 3/8" thick MDF either sides including termite treatment (using anty termite clear liquid by Jaffar bothers or approver equivalent), 3/8" thick MDF either sides etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		FG1	180 Sft	Sft		

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
7.3	N.S.I	<b>FIRE RATED DOORS</b> Providing and fixing wooden fire rated doors single & double leaf as per drawing with frames factory fabricated meet the requirements of the BM TRADA "Q" Mark Third Party Accredited scheme, tested in accordance with BS476 Pt22 1987 achieving a FD 60 minutes fire resisting rating. including standard fire door hardware fire rated locks or exit devices with latching units and exposed door closer (derma or equivalent) key and thumb turn concealed /SS with SS hinges complete 50mm wall size frame and spray paint finish etc., complete from Safeco or approved as per specifications & relevant drawings, and to the entire satisfaction of the Engineer(at any height & any floor)	198 Sft	Sft		
7.4	N.S.I	<b>Wooden Cabinets</b> Providing making and fixing in position <b>floor mounted lower cabinets</b> (Pantry etc.) as per drawing at any height / floor, made of 3/4" thick coloured laminated (both face) Lasani board shutter free from formaldehyde including all around OAK wood lipping kitchen cabinet, 3" x 1-1/2" thick Partal wood frame, complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved as per manufacturer's instruction & specification including all required hardware's for fixing etc.,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. <b>(Front face will be measured for payments)</b>				
		Ground Floor	105 Sft	Sft		
		First Floor	105 Sft	Sft		
		Second Floor	105 Sft	Sft		
7.5	N.S.I	Providing making and fixing in position wall mounted cabinets for (Kitchen etc.) as per drawing at any height / floor, made of 3/4" thick colored laminated (both side) Lasani board shutter free from formaldehyde including all around Deodar wood lipping 3/8" thick, 3" x 1-1/2" thick Partal wood frame, 6mm one side laminated Lasani board back complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved equivalent as per manufacturer's instruction & specification including all required hardware's for fixing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. <b>(Front face will be measured for payments)</b>				
		Ground Floor	105 Sft	Sft		
		First Floor	105 Sft	Sft		
		Second Floor	105 Sft	Sft		
<b>Total Carried to Summary</b>						
11		<b>EXTERNAL FINISHES</b>				
11.1	N.S.I	Providing & Laying Natural Sand stone on wall (straight, curved, arches etc.) with cement sand mortar 1:2 and in any pattern in as per direction of the engineer-in-charge including the cost of curing, making the stone surface smooth etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	15876 Sft	Sft		

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
11.2	N.S.I	Providing, fabricating and fixing <b>Roof Skylight</b> comprising of timber (oak wood) angular trusses / purlins / rafters with 1/2" laminated and tempered tinted (green) glass, infill panels fixed in wooden framing all as per details and design drawings. All timber sections & members to be painted (ICI, Berger, Jotun or equivalent) enamel paint (3 coats + 1 under coat) of approved colour. skylight to be fixed on top of RCC lintels / beams above high level windows Contractor is to be ensure stability of Skylight structure due to self weight (dead load) & high wind pressure & uplift etc. Complete in all respect as per drawings, specification and as directed by the Engineer. (Shop drawing and load /wind calculation to be provided for approval before fabrication)	548 Sft	Sft		
11.3	N.S.I	<b>External Building LOGO's</b> Provide, make, finish and fix in position LOGO & LETTERING (" <b>SINDH MADRESSATUL ISLAM UNIVERSITY -FACULTY OF MEDIA STUDIES &amp; SOCIAL SCIENCES</b> ") lettering with 48" dia Logo) on External walls including 2" thick Plaster in 1:4 cement, sand mortar with LOGO made of Stainless Steel Sheet (size as shown in drawing), fixed to walls with 3" long steel rowel bolts, strictly according to drawings, this includes three coats of plastic emulsion paint and preparation of surface with filling manufactured by ICI, all nails, screws, glues etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.  a) Lettering with 4' dia Logo  b) Logo Plaster (6'-0" x 24'-6")	70 Each 300 Sft	Each Sft.		
11.4	N.S.I	<b>Rain Water Spouts</b> Providing, Making and Fixing in position R.C.C Precast Rain Water spouts (size as shown in drawing), complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	30 Each	Each		
11.5	N.S.I	Providing, Making and Fixing ornamental columns, and ball finial comprising of artificial sand stone round & other geometrical shape over around windows & parapet wall (size as shown in drawing), complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.  a) Ornamental Pre cast Columns	320 Rft	Rft		
11.6	N.S.I	b) Ornamental Pre cast ball finial with base Providing & Laying pre cast cornices with 3000 psi concrete over columns, walls, arches & where required with cement sand mortar 1:2 in any pattern in as per direction of the engineer-in-charge including the cost of curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	36 Nos 756 Rft	Nos Rft		
<b>Total Carried to Summary</b>						

S.No	PWD Schedule 2012 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
12		<b>EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)</b>				
12.1	N.S.I	Providing and laying Terrazzo tiles/slab with bull nosing in <b>one piece /full length (up to 5 feet long) 1-1/2" thick for Treads</b> consisting of 3/4" thick topping 1:2 (One gray cement 2 approved marble chips No. 0 to 4 & chapcha) <b>in white cement</b> over a base 1:2:4 (One cement, two sand & four crush) cement concrete 3/4" thick in any floor laid with cement slurry/dry over existing surface including jointing with approved quality grouting material & grinding, polishing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	1207 Sft	Sft		
12.2	N.S.I	Providing and laying <b>Terrazzo tiles/slab in one pieces for Risers at</b> consisting of 1/2" thick 1:2 (One gray cement 2 approved marble chips No. 0 to 4) laid with cement slurry/dry board over exiting surface in any floor including jointing with approved quality grouting material & grinding, polishing complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	754 Sft	Sft		
12.3	N.S.I	Providing and making <b>Planter/ land escaping</b> as shown on drawing all works comprising (earth filling, sweet earth with manure plants and grassing compacting, curing, finishing & leveling) etc., excluding Tree, complete in all respects as per drawing, standard, specifications and direction of the Engineer.	1255 Sft	Sft		
<b>Total Carried to Summary</b>						

# **ELECTRIC WORK**

S. NO.	DESCRIPTION	TOTAL AMOUNT IN PAK RUPEES
<b>NON-SCHEDULE ITEMS</b>		
1	INTERNAL ELECTRIFICATION	
2	L.V. PANELS & DISTRIBUTION BOARDS	
3	LOW VOLTAGE CABLES AND WIRES	
4	CONDUITS & PIPES	
5	WIRING ACCESSORIES	
6	LIGHT FIXTURE & FANS	
7	EXTERNAL LIGHTING	
8	UPS SYSTEM <b>(On HOLD)</b>	
9	CABLE TRAY	
10	EARTHING SYSTEM	
11	LIGHTNING PROTECTION SYSTEM (LPS)	
	<b>TOTAL AMOUNT</b>	

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>NON-SCHEDULE ITEMS</b>					
<b>1</b>	<b>INTERNAL ELECTRIFICATION</b>				
<b>a)</b>	<b><u>3 WIRE IN PVC RECESSED CONDUIT</u></b>				
i	Wiring for sub-main with 3x 1.5 mm <sup>2</sup> , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4") dia PVC conduit recessed in the wall, column and roof etc as required.	19,770	Per Mtr.		
ii	Wiring for sub-main with 3x 2.5 mm <sup>2</sup> , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4") dia PVC conduit recessed in the wall, column and roof etc as required.	5,577	Per Mtr.		
iii	Wiring for sub-main with 3x 4 mm <sup>2</sup> , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4") dia PVC conduit recessed in the wall, column and roof etc as required.	7,365	Per Mtr.		
iv	Wiring for sub-main with 3x 6 mm <sup>2</sup> , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 25 mm (1") dia PVC conduit recessed in the wall, column and roof etc as required.	500	Per Mtr.		
<b>b)</b>	<b><u>4 CORE CABLE IN SURFACE PVC CONDUIT</u></b>				
i	Wiring for sub-main with 4 core, 10 mm <sup>2</sup> , stranded copper conductor, PVC insulated & PVC sheathed circular/flat cable in 40 mm (1½") dia PVC conduit fitted on surface as required.	140	Per Mtr.		
<b>c)</b>	<b><u>BATTEN/ ANGLE HOLDER, CEILING ROSE, BELL/ INDICATORS</u></b>				
i	Providing & fixing 6 Amps plastic ceiling rose on wooden Round block/Round Cover fitted on surface including connection as required.	110	Each		
<b>d)</b>	<b><u>CEILING FANS</u></b>				
i	Providing & installing 140 Cm (56") sweep ceiling fan with blades, canopy, standard length of down rod including connection with 14.0076" flexible wire complete as required. (without regulator) Millat/Pak/Asia/ Younas/Climax/ Royal.	90	Each		



S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
e)	<b><u>PLASTIC BODY EXHAUST FANS</u></b>				
i	Providing & installing 20 Cm (8") sweep, Plastic body Exhaust fan complete with blades, motor, etc fitted in existing hole including connection with 14/.0076" flexible wire complete as required Millat/Pak/Asia/ Younas/Climax/Royal.	5	Each		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>2</b>	<b>L.V. PANELS &amp; DISTRIBUTION BOARDS</b>				
a)	Supply, installation, testing & commissioning of Wall/Flush mounted Main Distribution Board (MDB) / Sub Main Distribution Board (SMDB) / Distribution Boards (DB), made with 16 SWG sheet steel metal, as per single line diagram, dust protected, vermin proof housing coated with approved color having all the necessary switching & protections, including all mounting accessories as per specifications and drawings, complete in all respect.				
i	MDB-SMMS	1	No.		
ii	SMDB-MS-1F	1	No.		
iii	SMDB-MS-2F	1	No.		
iv	DB-MS-GF1	1	No.		
v	DB-MS-GF2	1	No.		
vi	DB-MS-GF-AC	1	No.		
vii	DB-MS-GF-ICT	1	No.		
viii	DB-MS-1F1	1	No.		
ix	DB-MS-1F2	1	No.		
x	DB-MS-1F-AC	1	No.		
xi	DB-MS-1F-ICT	1	No.		
xii	DB-MS-2F1	1	No.		
xiii	DB-MS-2F2	1	No.		
xiv	DB-MS-2F-AC	1	No.		
xv	DB-MS-2F-ICT	1	No.		
xvi	DB-MS-ROOF	1	No.		
b)	Supply, installation, testing & commissioning of following Isolators, in 16 SWG sheet steel enclosure with neutral and earth terminal strips, including all mounting accessories as per specification & drawing, complete in all respect.				
i	40A, TPN Isolator	2	Nos.		
ii	30A, TPN Isolator	6	Nos.		
iii	32A, SPN Isolator	14	Nos.		
iv	20A, SPN Isolator	78	Nos.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>3</b>	<b>LOW VOLTAGE CABLES AND WIRES</b> Supply, laying, termination and commissioning of following copper conductor cable In already laid PVC conduit / cable tray / trench as required as per drawing and specification ,complete in all respect.				
a)	<b>4 Core - Cu.XLPE/PVC Cable (600/1000V)</b>				
i	4 Core - 120 Sq.mm	25	Mtr.		
ii	4 Core - 95 Sq.mm	15	Mtr.		
iii	4 Core - 50 Sq.mm	40	Mtr.		
iv	4 Core - 35 Sq.mm	25	Mtr.		
v	4 Core - 25 Sq.mm	30	Mtr.		
vi	4 Core - 16 Sq.mm	35	Mtr.		
b)	<b>1 Core - CU/PVC Cable as ECC</b>				
i	1 Core - 70 Sq.mm Cu/PVC Cable	25	Mtr.		
ii	1 Core - 50 Sq.mm Cu/PVC Cable	15	Mtr.		
iii	1 Core - 35 Sq.mm Cu/PVC Cable	25	Mtr.		
iv	1 Core - 25 Sq.mm Cu/PVC Cable	40	Mtr.		
v	1 Core - 16 Sq.mm Cu/PVC Cable	35	Mtr.		
vi	1 Core - 10 Sq.mm Cu/PVC Cable	140	Mtr.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>4</b>	<b>CONDUITS &amp; PIPES</b>				
a)	Providing and laying of following size (inner dia) PVC / UPVC Conduit as race ways with all accessories recessed / surface on wall / column / under floor for Power. As per specifications and drawings, complete in all respect.				
i	38 mm dia PVC	50	Mtr.		
ii	50 mm dia PVC	40	Mtr.		
b)	Providing and laying of UPVC (Class-D) pipe having dia of following size. Buried in ground as per drawing. Including excavation for laying of pipe and backfilling with clean sand (under and above pipe), compaction, concrete, plugging of pipe ends etc. as shown on drawing complete in all respect.				
i	100 mm dia UPVC (Class-D)	6	Mtr.		
c)	Providing and Construction of Manhole Size 600x600x900 mm deep, 6" thick, concrete 1:2:4 ratio with 600mm round heavy duty cast iron cover, 100% water proof, complete in all respect.	1	No.		
d)	Providing & installing of Pull Box as per drawing and specification, complete in all respect.	3	No.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>5</b>	<b>WIRING ACCESSORIES</b>				
a)	Supply, installation, testing & commissioning of following 10/13/15/20A, gang type switches, Dimmer Switches, Sockets including 16 SWG Sheet Steel powder coated back Boxes with earth terminal, recessed in wall, with all accessories as per specification, complete in all respects.				
i	10A, One Gang Switch	28	Nos.		
ii	10A, One Gang Switch (2-Way)	25	Nos.		
iii	10A, Two Gang Switch	46	Nos.		
iv	10A, Three Gang Switch	29	Nos.		
v	10A, Four Gang Switch	43	Nos.		
vi	10A, Double Pole Switch	17	Nos.		
vii	20A, Double Pole Switch	13	Nos.		
viii	ON & OFF Push Button	16	Nos.		
ix	One Gang Dimmer with 10A Switch	6	Nos.		
x	Two Gang Dimmer with 10A Switch	42	Nos.		
xi	10A, 2-Pin 1-Gang Switched Socket Outlet	254	Nos.		
xii	10A, 2-Pin 1-Gang Switched Socket Outlet Weatherproof type	4	Nos.		
xiii	13A, 3-Pin Flat 2-Gang Switched Socket Outlet	258	Nos.		
xiv	13A, Unswitched Spur Outlet	15	Nos.		
xv	15A, 3-Pin Switched Socket Outlet	6	Nos.		
xvi	Flex Outlet	30	Nos.		
xvii	16A, 3-pin Three Phase Industrial Socket with plug top	3	Nos.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>6</b>	<b>LIGHT FIXTURE &amp; FANS</b>				
a)	Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
i	Type - D1	266	Nos.		
ii	Type - D2	106	Nos.		
iii	Type - D3	99	Nos.		
iv	Type - D4	31	Nos.		
v	Type - D5	27	Nos.		
vi	Type - D6	15	Nos.		
vii	Type - LD1	143	Nos.		
viii	Type - LD2	387	Nos.		
ix	Type - T1	3	Nos.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>7</b>	<b>EXTERNAL LIGHTING</b>				
a)	Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
i	Type - FS1	22	Nos.		
ii	Type - S1	24	Nos.		
iii	Type - R1	50	Nos.		
iv	Type - W1	33	Nos.		
v	Type - W2	17	Nos.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>8</b>	<b>UPS SYSTEM</b>				
a)	Providing, installing, testing & commissioning of True Online Double Conversion UPS rating 50 kVA Three Phase in, Three Phase out, minimum 0.9 output power factor with 10 minutes battery backup, batteries with related DC cables from UPS to batteries, external By-pass and all accessories as per specification & drawings, complete in all respect.		Nos.		
b)	Providing, installing, testing & commissioning of True Online Double Conversion UPS rating 20 kVA Three Phase in, Three Phase out, minimum 0.9 output power factor with 10 minutes battery backup, batteries with related DC cables from UPS to batteries, external By-pass and all accessories as per specification & drawings, complete in all respect.		No.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					



S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>9</b>	<b>CABLE TRAY</b>				
a)	Providing, fabricating, erecting, fixing and installing of following size of base perforated Cable Tray, Fabricated with 16 SWG MS Sheet steel Hot dip Galvanized including all installation accessories (Hot Dip Galvanized) such as appropriate sizes and lengths of MS Rod / Angle Iron Supports and Rawl Bolts, including cutting, welding, jointing and necessary required hardware etc. Complete in all respect as shown in drawings and specification or as directed by the Engineer.				
i	6" x 2" (150mm x 50mm)	135	Mtr.		
ii	12" x 2" (300mm x 50mm)	115	Mtr.		
iii	18" x 2" (450mm x 50mm)	35	Mtr.		
iv	24" x 2" (600mm x 50mm)	15	Mtr.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>10</b>	<b>EARTHING SYSTEM</b>				
a)	Supply, installing, testing and commissioning of following items for complete earthing system including all connecting accessories as per drawings and specifications complete in all respect.				
i	Earth pit with Rod type earth electrode, 3/4" dia and 3 meters long copper rod .	2	Nos.		
b)	Supply, installing, testing and commissioning of following items for complete clean earthing system including all connecting accessories as per drawings & specifications complete in all respect.				
i	Earth pit with Rod type earth electrode, 3/4" dia and 3 meters long copper rod .	1	No.		
c)	Supply, Installation, Testing and Commissioning of Earth Copper Bar (MDB) 300x50x6 mm for earthing system as per drawings and instruction of consultant.	2	Nos.		
d)	Supply, laying, testing and commissioning of 1x16 Sq.mm PVC insulated Cu. Conductor cable as earth continuity conductor (ECC) in 25 mm dia uPVC conduit, complete in all respect.	30	Mtr.		
e)	Supply, laying, testing and commissioning of 1x25 Sq.mm PVC insulated Cu. Conductor cable as earth continuity conductor (ECC) in 25 mm dia uPVC conduit, complete in all respect.	10	Mtr.		
f)	Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable as earth continuity conductor (ECC) in 32 mm dia uPVC conduit, complete in all respect.	30	Mtr.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
<b>11</b>	<b>LIGHTNING PROTECTION SYSTEM (LPS)</b>				
a)	Supply, installation, testing and commissioning of 27mm x 2mm Tinned Copper Tape to be run on roof and on the elevation of the building as required and shown on drawings including all fixing accessories etc., as per specification, as per site requirement necessary for the functioning of the system and drawing, complete in all respect.	230	Mtr.		
b)	Supply, installation, testing and commissioning of Early Streamer Emission (ESE) Air Terminal mounted on 2 meter elevation mast, as per drawing, complete in all respect and having following specifications:  Efficiency: 60 micro seconds Lightning current withstanding test (10/350µs): 100 kA  ESE Central Rod: Nickel Plated Copper Metal Housing : Stainless Steel 316L Protection Radius : 42-49 meter at 2 meter height	1	No.		
c)	Providing and installation of 2 meter high elevation mast consisting side wall mounting bracket for installation and fixing of ESE Air Terminal, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	1	No.		
d)	Providing and installation of pyramid holdfasts / studs filled with cement for holding and supporting the flat tape conductor, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	80	Nos.		
e)	Providing and installation of lightning flash counter as per drawing and specification as per site requirement necessary for the system, complete in all respect.	1	No.		
f)	Providing and installation of Earth Electrode Copperbond earth rod 3 meters and clamp, Polypropelene earth pit, as per drawing and specification, complete in all respect.	6	Nos.		
g)	Providing and installation of Test Clamp and Guard Tube 2 m in length, as per drawing and specification, as per specification, as per site requirement necessary for the functioning of the system, complete in all respect.	2	Job.		
h)	Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable in 32 mm dia uPVC Pipe at ground level connecting Lightning protection pits to power earthing pits, complete in all respect.	10	Mtr.		
<b>CARRIED TO ELECTRICAL SUMMARY =====&gt;&gt;&gt;&gt;</b>					

# **ELV WORK**

## SUMMARY OF COST

S. NO.	DESCRIPTION	TOTAL AMOUNT IN PAK RUPEES
<b>A. SCHEDULE ITEMS</b>		
	SUB-TOTAL-A Rs.	
	Add _____% Above/Below/At par on Electrical Works of Composite Schedule of Rates PWD-2004	
	TOTAL-A Rs.	
<b>B. NON-SCHEDULE ITEMS</b>		
1	CONDUITS & PIPES	
2	VOICE, DATA COMMUNICATION & CCTV CABLING SYSTEMS (Passive Equipment Only) <b>(Equipments &amp; cabling on HOLD, only conduiting in Contractor's Scope)</b>	
3	PA (PUBLIC ADDRESS / VA (VOICE EVACUATION) SYSTEM <b>(Equipments &amp; cabling on HOLD, only conduiting in Contractor's Scope)</b>	
4	PUBLIC ADDRESS / BACKGROUND MUSIC SYSTEM FOR SEMINAR HALL <b>(On HOLD)</b>	
5	ACCESS CONTROL SYSTEM <b>(On HOLD)</b>	
6	CCTV SYSTEM <b>(On HOLD)</b>	
7	ADDRESSABLE FIRE ALARM SYSTEM <b>(Equipments &amp; cabling on HOLD, only conduiting in Contractor's Scope)</b>	
8	SELF CONTAINED EMERGENCY LIGHTS	
9	CABLE TRAY	
	TOTAL-B Rs.	
	TOTAL AMOUNT (A+B)	

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
<b>PART-B (NON-SCHEDULE ITEMS)</b>						
1		<b>CONDUITS &amp; PIPES</b>				
a)		Providing and laying of following size UPVC pipe of Class D for Telecommunication Cable (copper / optic fiber). Buried in ground / under roads / under floor as per specification. Including excavation for laying of pipe, bricks, warning tape and backfilling with new and fresh soil etc., as shown on the drawing, complete in all respect.				
i		2" dia UPVC	35	Mtr.		
b)		Providing and Construction of Manhole Size 2' x 2' x 3' mm deep 6" thick concrete 1:2:4 ratio with 2' round heavy duty cast iron cover, 100% water proof, complete in all respect. (For Incoming Telecommunication cables ).	1	No.		
c)		Providing & installing of Pull Box as per drawing and specification, complete in all respect.	1	No.		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;</b>						

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
2		<b>VOICE, DATA COMMUNICATION &amp; CCTV CABLING SYSTEMS (Passive Equipment Only)</b>				
a)		Providing, installation, testing and commissioning of following Data / Voice Cabinets, for patch panel, Fiber panels, adapter, PDU's,Fans and space for active switches as it may require to accommodate complete the entire passive and active network as per the single line diagram drawing and specification, complete in all respect.				
i		42U Data Rack in IT Room & Server Room (800mmx1000mm)		Nos.		
b)		Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for Voice with shutter type and 16 SWG back box including tagging,as per drawing and specification, complete in all respect.		Nos.		
c)		Providing, fixing, testing and commissioning of 4 Pair RJ-45, Cat-6 Simplex Outlet (for Data) with I/O - Shutter type with 16 SWG back box as per drawing and specification, complete in all respect.		Nos.		
d)		Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for Camera with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.		Nos.		
e)		Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for WIFI with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.		Nos.		
f)		Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for Projector with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.		Nos.		
g)		Supply, laying, testing and commissioning of CAT-6, 4 pair cable for Single RJ-45 outlet (Data,Voice, Camera, Wifi, Projector and Access control system) in 25mm dia PVC conduit concealed/surface from each outlet to IDF racks, including tagging and piping with all necessary accessories, complete in all respect. <b>(Cabling on HOLD, only conduiting in Contractor's Scope)</b>	10460	Mtr.		
h)		Supply, laying, testing and commissioning of Cat 5 25 pair Backbone cable from MTJB to remaining TJB in already laid cable tray including with all the necessary accessories as per drawing and specifications, complete in all respect.		Mtr.		
j)		Supply, laying, testing and commissioning of 8 core multi mode OM3 Fiber optic cable from server room remaining IDF Racks in already laid cable tray including with all necessary accessories, as per drawing and specification, complete in all respect.		Mtr.		

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
k)		Supply, installing, testing and commissioning of 24 port Cat 6, RJ 45 UTP Patch Panel fully loaded with tool less jacks and rear cable manager, as per drawing and specification, complete in all respect.		Nos.		
l)		Supply, installing, testing and commissioning of 24 port Fiber Patch Panel fully loaded with pigtails etc., and rear cable manager, as per drawing and specification, complete in all respect.		Nos.		
m)		Supply, installing, testing and commissioning of 19" front/rear (as required) cable organizer between patch panels and active equipment to provide patch cable management including with all necessary accessories, as per drawing and specification, complete in all respect.		Nos.		
n)		Providing, installation, testing and commissioning of CAT-6 UTP (RJ-45 to RJ-45) for the above Patch Panels including with all necessary accessories, as per drawing and specification, complete in all respect.				
i)		CAT-6 (1m) Long Patch Cord.		Nos.		
ii)		CAT-6 (2m) Long Patch Cord.		Nos.		
o)		Supply, installing, testing and commissioning of following blocks in Telephone junction boxes as per drawing and specification, complete in all respect.				
i)		50 Pair IDC Block		Nos.		
ii)		100 Pair IDC Block		No.		
p)		Providing, fixing, testing and commissioning of Floor Distribution Box with 1No. Dual RJ-45 Outlet (for Voice and Data), 1No.13A, Duplex Switched Socket Outlet and 1No. 10A, 2-pin Switched Socket Outlet and I/O - Shutter type with 16 SWG back box, as per drawing and specification, complete in all respect.		Nos.		
q)		Installation, testing and commissioning by Manufacturer Authorized Agent / Dealer and handing over complete Voice & Data System to Owner with Providing Training voice data fuke & OTDR Testing,as build drawing,Rack layouts and certification's Principal, complete equipment's Manual and Warranty Documents to Owners representative.		Job.		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;</b>						



S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
<b>3</b>		<b>PA (PUBLIC ADDRESS / VA (VOICE EVACUATION) SYSTEM</b>				
a)		Providing, laying, testing and commissioning of Wiring for complete PA System with 2C - 1.5 Sq.mm shielded, twisted pair Fire Resistant Cable in 25 mm dia PVC conduit concealed as per drawing and specification. Complete in all respect. <b>(Cabling on HOLD, only conduiting in Contractor's Scope)</b>	415	Mtr.		
b)		Supply, wiring and testing of PA Microphone points with Microphone Cable in 25mm dia PVC Conduit, recessed / surface in wall and ceiling, complete in all respects.		Job.		
c)		Supply, installation, testing and commissioning of PA System complete with all connecting accessories comprising of the following equipment, as per drawing and specification, complete in all respects.				
i		System Manager with built in slop for modules and message manager, as per drawing and specification, complete in all respects.		No.		
ii		Remote Microphone for upto 10 Zones with frequency response 100 Hz to 20 KHz and unidirectional electret condenser microphone goose neck table type with RJ45 connector, shielded twisted pair cable, indicators for power, failure, broadcast switch, covered switch, as per drawing and specification, complete in all respects.		No.		
iii		150W Power Amplifier module with frequency response 40 Hz to 20 KHz and 100V output voltage (EN54 compliant), as per drawing and specification, complete in all respects.		No.		
iv		Power supply manager with RJ45 female connector for connecting the system and cascade connection with shielded twisted pair straight cable and with indications battery check, charging circuit failure, battery failure (EN54 compliant), as per drawing and specification, complete in all respects.		No.		
v		Providing & Connecting of Inter Connects Cables etc.		Job.		
vi		19' Rack Cabinet with Glass Door to accommodate above equipment's located at Security room as per drawing and specification, complete in all respects.		No.		
d)		Supply, installing, testing and commissioning of following type Speakers of Architect Approved color, as per drawing and specification, complete in all respects.				
i		6W Ceiling mounted Speakers with Tapping Transformers (1,1.5,3,4.5,6W), EN54 Compliant.		No.		
ii		6W Surface mounted Speakers with Tapping Transformers (1,1.5,3,4.5,6W) and surface mounted boxes, EN54 Compliant.		No.		
e)		Installation, testing & commissioning, Programming by Manufacturer Authorized Agent / Dealer and handing over complete PA System to Owner with providing training, SOP, complete equipment's manual and warranty documents to Owners representative.		Job.		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;&gt;</b>						

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
4		<b>PUBLIC ADDRESS / BACKGROUND MUSIC SYSTEM FOR SEMINAR HALL</b>				
a)		Supply, installation, testing and commissioning of 180W Line Array Speakers with 8 ohm rated impedance and matching transformer along with mounting bracket as per drawing and specification, complete in all respect.		No.		
b)		Supply, installation, testing and commissioning of Digital stereo mixer with frequency response from 20 to 20 KHz with ARC, FBS and ACG signal processing function along with mounting bracket as per drawing and specification, complete in all respect.		No.		
c)		Supply, installation, testing and commissioning of gooseneck electret condenser microphone with base stand as per drawing and specification, complete in all respect.		No.		
d)		Supply, installation, testing and commissioning of dual channel power amplifier (2x250W) with 50 to 20 KHz frequency response and matching transformer as per drawing and specification, complete in all respect.		No.		
e)		Supply, installation, testing and commissioning of UHF Wireless microphone with 576 to 937 UHF frequency range with built in antenna as per drawing and specification, complete in all respect.		No.		
f)		Supply, installation, testing and commissioning of UHF Wireless tuner with 64 selectable frequencies and external antenna input as per drawing and specification, complete in all respect.		No.		
g)		Providing, laying, testing and commissioning of 2C - 1.5 Sq.mm PVC cable in 25 mm dia PVC conduit, as per drawing and specification. Complete in all respect.		Job		
h)		19" 12U Rack, Glass Door Imported, lock & keys		No.		
j)		Complete testing & commissioning, software end-user training with 1 years free services.		Job		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;&gt;</b>						

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
5		<b>ACCESS CONTROL SYSTEM</b>				
a)		Supply, installing, testing and commissioning of 2 Door Controller LAN Based with power supply, as per drawings and specification, complete in all respect.		No.		
b)		Supply, installing, testing and commissioning of BIO Proximity Card Reader, as per drawings and specification, complete in all respect.		No.		
c)		Supply, installing, testing and commissioning of Exit Control Push Button, as per drawings and specification, complete in all respect.		No.		
d)		Supply, installing, testing and commissioning of Electromagnetic Door Lock with matching power supply, as per drawings and specification, complete in all respect.		No.		
e)		Supply, installing, testing and commissioning of PVC Card for Reader as per drawing and specifications, complete in all respect.		Nos.		
f)		Installation, testing, commissioning & programming by Manufacturer Authorized Agent / Dealer and handing over complete Access Control System to Owner with providing training, SOP, complete equipment's manual and warranty documents to Owner's Representative.		Job.		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;</b>						

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
6		<b>CCTV SYSTEM</b>				
a)		Supply, installing, testing and commissioning of 2 MP IP based camera with 1/2.8" CMOS 3.3 to 12mm varfocal lens, power adopter, wall mounted bracket, and IP-65 housing, complete in all respect with fixing accessories, as per drawing and specifications, complete in all respect.		Nos.		
b)		Supply, installing, testing and commissioning of 2 MP IP based indoor Dome camera with 1/2.8" CMOS 3.3 to 9mm varfocal lens, power adopter, complete in all respect with fixing accessories and bracket assembly, as per drawing and specifications, complete in all respect.		Nos.		
c)		Installation, testing, commissioning, programming by Manufacturer Authorized Agent / Dealer and handing over complete CCTV System to Owner with providing training, SOP, complete equipment's manual and warranty documents to owners representative.		Job.		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;</b>						

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
7		<b>ADDRESSABLE FIRE ALARM SYSTEM</b>				
a)		Providing, laying, testing and commissioning of Wiring for complete Fire Alarm System with 2C-1.5 Sq.mm shielded, twisted pair Fire Resistant Cable in 25 mm dia PVC conduit concealed, (M.S conduit for surface) etc., including any wiring between fire alarm control panel and other's systems control panel's etc. Complete in all respect. <b>(Cabling on HOLD, only conduiting in Contractor's Scope)</b>	930	Mtr.		
b)		Providing, installation, testing and commissioning of Addressable Photoelectric Smoke Detector with base and back box, as per drawing and specification, complete in all respect.		Nos.		
c)		Providing, installation, testing and commissioning of Addressable Heat Detector with base and back box, as per drawing and specification, complete in all respect.		Nos.		
d)		Providing, installation, testing and commissioning of Addressable Manual Call Point with base and back box, as per drawing and specification, complete in all respect.		Nos.		
e)		Providing, installation, testing and commissioning of Addressable Manual Call Point (Weatherproof) with base and back box, as per drawing and specification, complete in all respect.		No.		
f)		Providing, installation, testing and commissioning of Addressable Sounder with flasher and base and back box, as per drawing and specification, complete in all respect.		Nos.		
g)		Providing, installation, testing and commissioning of Addressable Sounder (Weatherproof) with flasher, base and back box, as per drawing and specification, complete in all respect.		Nos.		
h)		Providing, installation, testing and commissioning of 02 Loop Addressable Fire Alarm Control Panel (FACP), including all necessary accessories, identification tagging etc. and battery back up. FACP as per drawing and specification, complete in all respect.		No.		
j)		Installation, testing and commissioning, Softwear, Programming by Manufacturer Authorized Agent / Dealer and handing over complete Fire Alarm system to owner with providing training, SOP, complete equipment's manual and warranty documents to Owner's Representative.		Job.		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;</b>						

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
<b>8</b>		<b>SELF CONTAINED EMERGENCY LIGHTS</b>				
a)		Supply, installing, testing and commissioning of following items for self contained emergency lights with all fixing accessories as per drawing and specification, complete in all respect.				
i		7W, Emergency light with self contained Battery, Surface / Wall mounted IP-20 as per specification and drawing complete in all respect. (non-maintained)	67	Nos.		
ii		7W, Emergency light with self contained Battery, Ceiling mounted IP-20 as per specification and drawing complete in all respect. (non-maintained)	21	Nos.		
iii		7W, Emergency light with self contained Battery, Surface / Wall mounted IP-65 as per specification and drawing complete in all respect. (non-maintained)	25	Nos.		
iv		7W, EXIT light with self contained Battery, 40m viewing, Surface mounted IP-20 as per specification and drawing complete in all respect. (non-maintained)	54	Nos.		
<b>CARRIED TO ELV SUMMARY =====&gt;&gt;&gt;</b>						

S.No.	PWD Sched. 2004 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.					
1	2	3	4	5	6	7 = (4 x 6)
9		<b>CABLE TRAY</b>				
a)		Providing and Installing of following size of base perforated for ELV System, Fabricated with 14/16 SWG MS Sheet steel Hot dip Galvanized including all installation accessories (Hot Dip Galvanized) such as appropriate sizes and lengths of M.S Rod / Angle Iron Supports and Rawl Bolts etc. Complete in all respect as shown in drawings and specification or as directed by the Engineer.				
i		150 x 50mm 16 SWG	200	Mtr.		
ii		300 x 50mm 16 SWG	45	Mtr.		
CARRIED TO ELV SUMMARY =====>>>>						

# **PLUMBING WORK**



S. NO.	DESCRIPTION	TOTAL AMOUNT IN PAK RUPEES
<b>A. SCHEDULE ITEMS</b>		
1	Plumbing Fixtures	950,119
2	Sanitary Sewage	306,000
3	Manholes & Gully traps	174,420
	<b>SUB-TOTAL-A Rs.</b>	<b>1,430,539</b>
	_____ % Above/below on Plumbing Works of PWD-2012	
	<b>TOTAL-A Rs.</b>	
<b>B. NON-SCHEDULE ITEMS</b>		
1	Water Supply	
2	Sanitary Sewage	
3	Fire Fighting Works	
	<b>SUB-TOTAL-B Rs.</b>	
	<b>TOTAL AMOUNT (A+B) FOR 1 No.</b>	

Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
1	301-1	<p><b><u>PLUMBING FIXTURES:</u></b></p> <p>Providing and fixing best quality squatting type glazed earthward W.C.Pan, Pakistan (of not less than 18" clear opening as measured between the flushing rim) Complete with and including the cost of 13.6 liters best quality low level plastic flushing cistern with internal fittings complete, P.V.C. flushing pipe suitable for this type with fittings and making requisite number of holes in walls, plinth &amp; floor for pipe connections and making good in cement concrete 1:2:4.</p>	27	Nos.	3,425	92,475
2	301-6	<p>Providing and fixing Pakistani make best available quality European style white glazed earthenware wash down W.C.Pan complete with and including the cost of a plastic seat (PVC cover and buffers 3 galls. (13.6 liters) white glazed earthenware low level flushing cistern with siphon fittings, 1-1/2 inches (40mm) dia white porcelain enameled flush bend, 3/4 inch (20mm) dia, G.I. warning pipe carried outside and bent vertically downwards and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4</p>	32	Nos.	4,805	153,760
3	301-7	<p>Providing and fixing Pakistani make flat back lipid front urinal basin (of not less than 17 inches or 430 mm in height of white glazed earthenware complete with and including the cost of one gallon (4.5 liters) glazed earthen ware automatic flushing cistern with fittings a pet cock brackets standard flush pipe with fittings, standard waste pipe (enameled iron) connection complete and making requisite number of holes in walls plinth and floor for pipe connections and making good in cement concrete 1:2:4</p>	9	Nos.	2,804	25,236
4	301-8 & 10 & 14	<p>Providing and fixing 25 inches x 18 inches (635 mm x 457 mm) lavatory basin in white glazed earthenware (Pakistani) complete with and including the cost of Brass oxidized bolts kit built into wall 1/2 inch (15 mm) dia. Chrome plated mixer 1-1/4" inches (32mm) rubber plug and chrome plated brass chain, 1-1/4 inches (32 mm) dia brass waste of approved pattern, 1-1/4 inches (32 mm) dia. Malleable iron or C.P. brass traps malleable iron or brass unions and making requisite number of holes in walls plinth and floor for pipe connections and making god in cement concrete 1:2:4</p> <p>Extra over item No. 8 and 9 (Wasg basin) for providing and fixing best available (Pakistani make) white glazed earthenware pedestal..</p> <p>Extra over item No.8 and 9 for providing single hole chromium plated mixer tap 1/2 inch (15 mm) dia (English or approved foreign make).</p>	50	Nos.	7,225	361,250
<b>Continued..</b>						

Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
		<b><u>PLUMBING FIXTURES (Cont....)</u></b>				
5	301-13	Providing and fixing Shower tray made of fiber glass of any color and design 31 inches x 31 inches (787 mm x 787 mm).	0	Nos.	2,394	-
6	301-20	Providing and fixing standing wall shower of CP brass 3 knobs of approved quality mixer unit and moveable shower head complete..	0	Nos.	4,590	-
7	301-21	Providing and fixing approved quality stainless steel sink 60" x 20" Pak made (Atlas) complete with brass oxidized bolt kit/angle iron brackets built into walls ½" dia CP sink mixer 1-1/4" rubber plug and CP brass chain 1-1/4" CP brass waste 1-1/4" dia malleable iron or CP brass bottle trap with malleable iron or brass unions and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4	2	Nos.	18,677	37,354
8	302-6	Providing and fixing 20 inches x 16 inches (508 mm x 406 mm) Looking mirror of Belgium glass complete with Plastic frame and C.P. Brass screws.	50	Nos.	923	46,150
9	302-9	Providing and fixing bath room accessories of set of 6 pieces consist of one shelf, one towel rod with bracket, one soap dish, one tooth brush holder with glass and cover, one tissue paper holder one double hook one towel ring etc. complete of approved quality as per direction of Engineer in-charge.	15	Nos.	12,757	191,355
10	302-13	Providing and fixing chrome plated Muslim bib-cock without Muslim shower of approved quality	59	Nos.	721	42,539
		<b>CARRIED TO SUMMARY</b>				<b>950,119</b>

Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
1	306-27/28	<p><b><u>SANITARY SEWAGE:</u></b></p> <p>Providing and fixing un plasticized polyvinyl chloride pipe (P.V.C) "D" class and specials etc. including cutting and fitting complete with and including the cost of cutting trench up to 1-1/2 feet deep refilling, watering, ramming, and disposal of surplus earth within one chain and after cleaning the pipe and cartage within 10 miles (16.09 km.) (working pressure 12 kg/cm<sup>2</sup>) 1-1/4 inches (32 mm) dia.</p> <p>(i) 6" dia</p> <p>(ii) 8" dia</p>	600	Rft.	510	306,000
			0	Rft.	712	-
2	315-3	<p><b>Manholes and Gully traps</b></p> <p>Providing manhole Type 'B' size 3'-0" x 2'-6" or 914mm x 762mm x 4ft (1.22mm) deep as per approved design and specifications complete for 4" to 12" diameter pipe, 4 ft. to 7'-5" Depth with cast iron cover and frame weights 1 Cwt. 3 Qtrs or 88.9 kg, in 6" thick RCC 1:2:4 slab 8" thick, c.c. 1:3:6 block masonry walls set in 1:3 c.m. 6" inch thick, 1:3:6, c.c. in foundation 1:2:4 c.c. in benching, 1/2" thick cement plaster in 1:4 c.m. to all inside wall surfaces, channels and benching etc. and top including providing and fixing cast iron foot rest at every foot of depth and making requisite number of main and branch channels complete but excluding that cost of excavation, backfilling, disposal of excavated stuff, manhole cover and frame.</p>	10	Nos.	17,442	174,420
<b>CARRIED TO SUMMARY</b>						<b>480,420</b>

Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
<b>NON-SCHEDULE ITEMS</b>						
		<b>WATER SUPPLY:</b>				
		<b>Cold and Hot Water Supply Piping</b>				
1	Non-Sch	Supply, installation Testing and Commissioning of PPR PN - 20 Cold/Hot water pipes as per DIN 8077-8078 with molded fittings PN - 25 as per DIN 16962, including pipe supports a as indicated on the drawing, as per specifications and Engineers approval.				
i		¾" dia	1,010	Rft		
ii		1" dia	130	Rft		
iii		1¼" dia	260	Rft		
iv		1½" dia	190	Rft		
v		2" dia	420	Rft		
vi		2½" dia	980	Rft		
vii		3" dia	0	Rft		
viii		4" dia	0	Rft		
		<b>Valves</b>				
2	Non-Sch	Providing and fixing of PPR Coated, brass Gate valves (of same material as piping) as indicated on the drawing, as per specifications and Engineers approval.				
i		¾" dia	2	Nos.		
ii		1" dia	2	Nos.		
iii		1¼" dia	4	Nos.		
iv		1½" dia	4	Nos.		
v		2" dia	9	Nos.		
vi		2½" dia	1	Nos.		
vii		3" dia	0	Nos.		
viii		4" dia	0	Nos.		
		<b>Water Tanks and Connection</b>				
3	Non-Sch	Connection for water tank including with valves, supports, excavation and Backfill, complete all in accordance with the drawing and specifications.	1	Item		
4	Non-Sch	2" Connection to RCC water tanks	1	Nos.		
5	Non-Sch	Connection to overhead water tanks using Float switch	1	Nos.		
6	Non-Sch	Cast Iron Medium Duty Cover For RCC water tanks	2	Nos.		
<b>Continued..</b>						

Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
		<b>WATER SUPPLY (Cont....)</b>				
		<b>Plumbing Specialties:</b>				
7	Non-Sch	Supply and installation of the following including all fittings, fixings, accessories, etc., as indicated on the drawing, as per Specifications and Engineers approval.				
i		1" Air Relief Valve	1	Nos.		
ii		1¼" dia foot valve	1	Nos.		
iii		2" Y-type Strainer	2	Nos.		
iv		2" Flexible Connector	4	Nos.		
8	Non-Sch	<b>Pumps</b>				
	Non-Sch	Supply and installation of below mentioned Transfer Pump Set including pump foundation, control panel, automatic float switch, wiring, valves, piping, accessories, etc., as indicated on the drawing, as per specifications and Engineers approval.				
i		Transfer Pump (1 duty+1 standby) Flow = 100GPM @ 130ft. head	1	set		
9	Non-Sch	<b>Water Filter</b>				
		Supply and installation of 3 stage UV Water filter having minimum flow rate of 0.5 gpm including valves, piping, accessories, etc., as indicated on the drawing, as per specifications and Engineers approval.	3	Nos.		
10		<b>Water Cooler</b>				
		Supply and installation of Stainless Steel Electric water cooler of below mentioned capacity with two taps, R-22 Refrigeration system, S.Steel Tank safety tested at 10kg/cm <sup>2</sup> (142 p.s.i.) with recommended maximum working pressure of 3kg/cm <sup>2</sup> (42 p.s.i.) including all accessories like Valves, interconnecting piping, Drain tray and drain connection s as indicated in the drawings, as per specifications and engineers approval.				
		WC-01 to 05 (65 GPH)	3	Nos.		
<b>CARRIED TO SUMMARY</b>			<b>Total</b>			

Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
		<b><u>SANITARY SEWAGE:</u></b>				
		<b>Soil, Waste, Vent and Rainwater Pipes</b>				
11	Non-Sch	Providing and fixing, uPVC pipes and fittings as per BS EN 1329 for above ground installations for Soil, Waste, Vent & Rw pipes including cleanout plug, clamps, hanger collars, supports, specials (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval.				
		(i) 2" dia	462	Rft.		
		(ii) 3" dia	702	Rft.		
		(iii) 4" dia	798	Rft.		
		(iv) 6" dia	0	Rft.		
		<b>Drainage Specialties</b>				
12	Non-Sch	Providing and fixing, PVC floor trap with multiple dia inlet and cleanout plug of the approved self cleaning design with S.Steel grating, as indicated on the drawing, as per specifications and Engineers approval.	57	Nos		
13	Non-Sch	Providing and fixing UPVC cowl for vent pipe of the following dia including all accessories complete in all respects.				
		(i) 3" dia	4	Nos		
		(ii) 4" dia	4	Nos		
		(iii) 6" dia	0	Nos		
14	Non-Sch	Providing and fixing, PVC Roof Drains as per specifications and Engineers approval.	4	Nos		
		<b>Continued..</b>				

Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
		<b><u>SANITARY SEWAGE (Cont....)</u></b>				
		<b>Gully traps</b>				
15	Non-Sch	Construction of 18" x 18" Cement Concrete gully trap with 12"x 12" manhole cover as specified and shown on the drawing, as per specifications and Engineers approval.	5	Nos.		
16	Non-Sch	<b>External Connection</b> Connection to external Sewage network, after obtaining approval from local authorities including the cost of excavation, Piping as specified and shown on the drawing, as per specifications and Engineers approval.	1	Job.		
		<b>CARRIED TO SUMMARY</b>	<b>Total</b>			



Item No.	PWD Schedule 2012	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
<b>SCHEDULE ITEMS</b>						
1		<b>FIRE FIGHTING</b> Supply and installation of below mentioned Portable Fire extinguishers with Wall mount brackets as indicated on the drawings, as per specifications and Engineers Recommendation				
i	Non-Sch	5 Kg CO2 wall mounted fire extinguisher	14	Nos.		
ii	Non-Sch	6 Kg Dry powder wall mounted fire extinguisher	14	Nos.		
iii	Non-Sch	12 Kg Automatic Dry Powder Fire extinguisher.	1	Nos.		
2		<b>Fire Piping</b> Supply, installation, testing and Commissioning of Seamless black steel SCH. 40 pipe as per ASTM A53 grade B with UL/FM Heavy Duty welded fittings, UL/FM Galvanized Supports and handers, supports, painting and coding fire protection system of following sizes.				
i		3" dia	270	Rft		
ii		1 1/4" dia	30	Rft		
3		<b>Fire Valves</b> Supply, installation, testing and Commissioning of UL/FM O.S and Y Ductile Iron Gate Valves with post indicator of Class 300 (UL) with EPDM Seal as per ASTM A536 Grooved or flanged type as required as per drawings, specifications and Engineers Recommendation.				
i		3" dia	1	Nos		
4		<b>Fire Hose Reel and Cabinet</b> Supply, installation, testing and Commissioning of Dual compartment Stainless Steel Fire Hose cabinet (Exposed or recessed type) comprising of below mentioned items with S.Steel lock and handle, as per drawings, specifications and Engineers Recommendation.  1" diameter, 30m high pressure rubber hose reel tested on 30 bar with PRV (Pressure Reducing valve), Gate Valve and inlet lock shield control valve and Adjustable plastic Nozzle for Jet, spray and Shut off. 2 1/2" , 100 ft Long lay flat hose Rack + Multi Jey nozzle 2 1/2" diameter Landing valve Dia UL/FM Approved 6 kg Co2 Extinguisher 5 KG ABC type Dry powder Extinguisher				
			6	Nos		
<b>Sub Total for Non Schedule Items</b>			<b>Total</b>			

# **HVAC WORK**

S. NO.	DESCRIPTION	TOTAL AMOUNT IN PAK RUPEES
1	DX- SPLIT TYPE AIRCONDITIONING UNITS	N/A
2	HVAC FANS	
3	CONDENSATE DRAIN PIPING	
4	DUCT WORKS & FLEXIBLE CONNECTOR	
5	AIR DEVICES	
6	HANGER & SUPPORTS	
7	CIVIL WORKS	
8	GENERAL MECHANICAL ITEMS	
	<b>GRAND TOTAL SUMMARY</b>	-

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6=(3X5)
1	<p><b>DX- SPLIT TYPE AIRCONDITIONING UNITS</b> Supply, Installation, Testing &amp; Commissioning of DX Split Air-conditioning Units, complete refrigerant piping, insulation, cladding, refrigerant tray, cable tray &amp; accessories. Indoor unit with all sections and components given in the schedule and specifications of DX Split Air-conditioning Units, including uplifting / lowering, loading / unloading at site, complete in all respect and as directed by the Engineer incharge in following sizes and capacities.</p> <p><b>GROUND FLOOR</b></p> <p>i DX-01 to 10 /CU-01 to 10 (1.0 TR Capacity Wall Mounted Type)</p> <p>ii DX-11/CU-11 (1.5 TR Capacity Wall Mounted Type)</p> <p>iii DX-12 to 19/CU-12 to 19 (1.0 TR Capacity Wall Mounted Type)</p> <p>iv DX-20 to 27/CU-20 to 27 (1.5 TR Capacity Wall Mounted Type)</p> <p>v DX-28 /CU-28 (1.0 TR Capacity Wall Mounted Type)</p> <p>vi DX-29 /CU-29 (1.5 TR Capacity Wall Mounted Type)</p> <p>vii CTU-01 to 08 /ODU-01 to 08 (2.0 TR Capacity Cassette Type)</p> <p>viii DX-30~31 /CU-30~31 (2.0 TR Capacity Wall Mounted Type)</p> <p><b>FIRST FLOOR</b></p> <p>i DX-01~06 /CU-01~06 (2.0 TR Capacity Wall Mounted Type)</p> <p>ii DX-07,09 &amp;11 /CU-07,09 &amp;11 (1.0 TR Capacity Wall Mounted Type)</p> <p>iii DX-08,10~14 /CU-08,10~14(1.5 TR Capacity Wall Mounted Type)</p> <p>iv DX-15~19 /CU-15~19 (1.0 TR Capacity Wall Mounted Type)</p> <p>v DX-20~22 /CU-20~22 (1.5 TR Capacity Wall Mounted Type)</p> <p>vi DX-23~28 /CU-23~28 (2.0 TR Capacity Wall Mounted Type)</p> <p><b>SECOND FLOOR</b></p> <p>i DX-01~06 /CU-01~06 (2.0 TR Capacity Wall Mounted Type)</p> <p>ii DX-07~21 /CU-07~21 (1.5 TR Capacity Wall Mounted Type)</p> <p>iii DX-22 /CU-22 (1.0 TR Capacity Wall Mounted Type)</p> <p>iv DX-23~25 /CU-23~25 (1.5 TR Capacity Wall Mounted Type)</p> <p>v DX-26~31 /CU-26~31 (2.0 TR Capacity Wall Mounted Type)</p> <p><b>ROOF</b></p> <p>i DX-01 /CU-01 (1.5 TR Capacity Wall Mounted Type)</p>				
<b>AMOUNT CARRIED TO HVAC SUMMARY</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6=(3X5)
2	<b>HVAC FANS</b> Supply, installation, testing and commissioning of HVAC fans, as per equipment schedule, as shown on the drawings including all labour, material and accessories, complete in all respect and to the satisfaction of engineer incharge.				
	<b>GROUND FLOOR</b>				
i	EF-01 ( 200 cfm)	1	Nos.		
ii	EF-02 & 03 (100 cfm)	2	Nos.		
iii	EF-04~6( 200 cfm)	3	Nos.		
iv	EF-07( 100 cfm)	1	Nos.		
v	EF-08( 350 cfm)	1	Nos.		
	<b>FIRST FLOOR</b>				
i	EF-01 ( 200 cfm)	1	Nos.		
ii	EF-02 (100 cfm)	1	Nos.		
iii	EF-03 ( 420 cfm)	1	Nos.		
iv	EF-04(100 cfm)	1	Nos.		
v	EF-05 (200 cfm)	1	Nos.		
vi	EF-06 (100 cfm)	1	Nos.		
vii	EF-07 (280 cfm)	1	Nos.		
viii	EF-08 (100 cfm)	1	Nos.		
	<b>SECOND FLOOR</b>				
i	EF-01 ( 200 cfm)	1	Nos.		
ii	EF-02 (100 cfm)	1	Nos.		
iii	EF-03 ( 420 cfm)	1	Nos.		
iv	EF-04(100 cfm)	1	Nos.		
v	EF-05 (200 cfm)	1	Nos.		
vi	EF-06 (100 cfm)	1	Nos.		
vii	EF-07 (280 cfm)	1	Nos.		
viii	EF-08 (100 cfm)	1	Nos.		
<b>AMOUNT CARRIED TO HVAC SUMMARY</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6=(3X5)
3	<b>CONDENSATE PIPING</b> Providing and fixing, uPVC Class 'E' pipes and fittings as per BS 3505 (EN 1401) for Condenser Water drainage including fittings, bends, cuttings, filling etc. as indicated on drawings, as per specifications and Engineers approval.				
i	1" dia	1560	Rft		
ii	1 1/4" dia	430	Rft		
iii	1 1/2" dia	120	Rft		
<b>AMOUNT CARRIED TO HVAC SUMMARY</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6=(3X5)
4	<p><b>DUCT WORKS</b> Supply, fabrication, installation, testing and commissioning of Sheet Metal hand made / machine fabricated Duct Work as shown on the drawings and as per technical specification including all labour, material, accessories, tees, plenum, transition pieces, splitter dampers, special duct test holes, duct access doors, air deflector, as where required complete in respect and to the satisfaction of Engineer incharge.</p> <p>i 24 - Gauge</p>	150	Sq.Ft		
5	<p><b>FLEXIBLE DUCT CONNECTOR</b> Supply and installation of rubber impregnated canvas Flexible Duct Connector (imported type) between Fans all other equipment and Duct Work as shown on the drawings including all labour, material, accessories, complete in respect and to the satisfaction of engineer incharge.</p>	2	Nos.		
<b>AMOUNT CARRIED TO HVAC SUMMARY</b>					





S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6=(3X5)
7	<p><b>HANGER &amp; SUPPORTS</b> Supply, installation, testing and commissioning of Galvanized Hanger and Supports for piping, ducting, all HVAC Equipments, as shown on the drawings and as specified in technical specification, complete with angle iron, rawal bolts, threading rods, nuts and bolts, wooden pieces, including the cost of cleaning, painting with corrosion resistant paint, jointing and welding, including all labour, material and accessories, complete in all respect and to the satisfaction of Engineer Incharge.</p>	1	Lot		
<b>AMOUNT CARRIED TO HVAC SUMMARY</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6=(3X5)
8	<p><b>CIVIL WORKS</b> Making and cutting in walls, slabs and preparation of RCC foundation for Condensing Unit, Fans and all other HVAC equipments in all other work such as Openings, Penetrations, Firestopping, Acoustic Cork sheet, Wooden Frame Sleeves and Pipe Sleeves, plaster finish etc as directed by Engineer Incharge, complete in all respect.</p>	1	Job		
<b>AMOUNT CARRIED TO HVAC SUMMARY</b>					

S.No.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6=(3X5)
9	<b>GENERAL MECHANICAL ITEMS</b>				
i	<b>SHOP DRAWINGS &amp; AS BUILT DRAWINGS</b> Providing Shop Drawings and As Built Drawings in A1 size, as advised by the Consultant, complete in all respect.	1	Job		
ii	<b>PAINTING &amp; FINISHES</b> Providing Painting and Finishing,as directed by the Engineer Incharge, complete in all respect.	1	Job		
<b>AMOUNT CARRIED TO HVAC SUMMARY</b>					

**Table of Contents:**

**1- General**

**2- Metal Work**

- 2.1. Metal Fabrication
- 2.2. Ornamental handrails and railings
- 2.3. Custom steel door and frames

**3- Wood, Plastic and Composite**

- 3.1. Wooden doors
- 3.2. Access doors and frames
- 3.3. Rough carpentry
- 3.4. Interior Architectural Woodwork
- 3.5. Termite Control

## **1 GENERAL**

- 1.01 This General Specification is to be taken as applying to all the works in this Contract. Figured dimensions on the working drawings shall be followed in preference to the scale.
- 1.02 Until and unless specified otherwise, all goods and materials are to be Pakistan manufactured and to be of the best quality, and where not otherwise specified shall be according to latest engineering practice and conforming to Pakistan Standards (P.S) or British Standard Specifications (B.S.S) or Standard of American Society of Testing Materials (ASTM). The Engineer or the Consultants may also supplement such specifications during the progress of work.
- 1.03 All materials and goods used for such and other items shall be subjected to standard testing and if found below the specified standard such as PS or BSS or ASTM or their equivalent shall be removed from the site immediately at Contractor's own expense. All testing of materials finished and unfinished, shall be carried out by the Contractor at his cost, in the presence of Engineer or Engineer or his Representative for which the Contractor shall maintain a reasonably well equipped laboratory of his own, close to the site of work or make any other additional arrangement to the satisfaction and convenience of the Engineer. The Contractor shall include testing charges in his quotations and shall not be entitled to any reimbursement on this account for routine testing.
- 1.04 The Contractor must give early attention to the submission of samples of materials for approval of the Engineer, indicating the names of the manufacturing firms where applicable especially of cement, sand, aggregates, steel, water, tiles, hard-core and all fittings. Whenever practicable, samples shall be submitted at least three weeks before it is proposed to use the materials. Until and unless specified otherwise and whenever materials are ordered to be forwarded to a testing laboratory other than site laboratory for check/ testing, the Contractor will be reimbursed the cost of fees for such tests if proved satisfactory, by the Employer. The Contractor, however, will be required to bear the cost of the fees for tests, which proved unsatisfactory.
- 1.05 The Contractor must take all steps necessary to prevent damage or interference with all supply lines such as water, electric power, fuel, telephones, drains, buried cables and any construction designed for the use of the public, government or semi government authorities or the Employer. The Contractor shall be responsible for any damage caused to such services or constructions and settle all claims in respect of such damage.
- 1.06 The Contractor shall protect from injury by covering all work, internally and externally needing protection including new concrete, Formwork, surface renderings, floors, etc., to the satisfaction of the Engineer, including the work of his sub-contractors at his own cost.
- 1.07 The whole work shall be carried out in the best manner in accordance with the instructions contained in these documents and those given by the Engineer

from time to time during the progress of the work. The work shall be carried out in conformity with the best of the standard construction practices preferably the British Codes of Practices.

- 1.08 The Contractor shall submit to the Engineer for his approval before beginning the work, a complete plan of the proposed sequence and methods of operations for the execution of the works. Detailed drawings showing the location and construction of dumping and working platforms, cranes, building and all other structures in connection with the Contractor's plant and material storage sheds shall also be submitted to the Engineer for his approval before construction.
- 1.09 Orders and directions may be given orally by the Engineer or his Representative, and shall be received and promptly obeyed by the Contractor or his Representative or any superintendent or foreman or any supervisor of the Contractor whosoever may have charge of the particular part or section of work in relation to which the orders or directions are given, and a confirmation in writing of such order or directions will be given to the Contractor by the Engineer, if so requested. The Contractor shall provide and maintain at his own expense during the performance of the work an office in the vicinity of work. Orders or directions, written or oral, from the Engineer or his Representative delivered at such office shall be considered as delivered to the Contractor. The Contractor's office shall be fitted with a telephone connected to the local Telephone Exchange.
- 1.10 The Contractor shall not use the site for any other purpose than that of carrying out this Contract work. The operations of the Contractor shall be confined to the area immediately adjoining the buildings and the works included in this Contract but site clearance shall be kept to the satisfaction of the Engineer to permit carrying out of other works by other Contractors. The Contractor shall not affix advertisements; neither shall he permit advertisements to be displayed without the written consent of the Engineer.
- 1.11 The contract drawings are the working drawings to guide the Contractor generally about the shape and size of all the structures and fittings. Before proceeding to make preparations, fabrication, execution, erection of any such fittings and other details of any temporary works, scaffolds, railings, shuttering, details of doors, windows, partitions, iron mongers work, etc.; the Contractor shall be under obligation to prepare and submit all detailed shop drawings to the satisfaction and the approval of the Engineer, before doing any or all of that described above or as directed. Approval of the contractor's drawings shall not relieve the Contractor for any part of his obligation to meet all the requirements of the specifications or correctness of his drawings. On site Mock-up and sample must be prepared and informed to engineer and client two weeks prior for visit.
- 1.12 No cement work shall be permitted during extreme cold weather when unless otherwise authorized by the engineer.

1.13 **PAYMENT**

Contractor shall not be entitled to any separate or additional payment on account of all these general requirements and any other arrangement or action Contractor has to undertake under the direction of the Engineer for a proper carrying out of the works and meeting all obligations of the Contract.

END OF SECTION

## **2 METAL**

### **2.1 METAL FABRICATION**

#### **PART 1 - GENERAL**

##### **2.1.1. RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

##### **2.1.2. SUMMARY**

- A. This Section covers items fabricated from steel, stainless steel or aluminum and are not covered under other Specification Sections, including, but not limited to, the following:
  - 1. Miscellaneous framing and supports.
    - a. Concealed applications where framing and supports are required.
    - b. Countertop support.
    - c. Vanity supports
    - d. Steel framing and supports for mechanical and electrical equipment.
    - e. Steel framing and supports for Architectural applications.
  - 2. Elevator machine beams, hoist beams, and divider beams.
  - 3. Support angles for elevator door sills.
  - 4. Shelf angles.
  - 5. Loose bearing and leveling plates.
  - 6. Steel welded plates and angles for casting into concrete not specified in other Sections.
  - 7. Miscellaneous steel trim including steel angle corner guards, steel edgings and loading-dock edge angles.

This Section includes the following metal fabrications:

- 8. Ladders.
- 9. Floor plate and supports.
- 10. Cast nosings, treads, and thresholds.
- 11. Pipe guards.
- 12. Pipe bollards.
- 13. Column protection guard.

Products furnished, but not installed, under this Section include the following:

- 14. Loose steel lintels.
- 15. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

Related Sections include the following:



16. 3.0 Section "Cast-In-Situ Concrete" for corner guards to be placed in forms of reinforced concrete columns and for concrete footings required for metal fabrications.
17. 4.0 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
18. 9.0 Section "Painting" for field applied paint finishes.

#### 2.1.3. DESIGN REQUIREMENTS

- A. Design Requirements: Design, engineer, fabricate, and install work in compliance with specified standards, performance requirements, material selections, and requirements of this Section and related sections.
  1. Provide work to withstand thermal movement, wind pressure, gravity loads, seismic loads and movement of building structure without failure. Work to remain free from defects.
    - a. **Seismic Load:** Uniform Building Code, 1997 Edition, zone 2A.
    - b. **Wind Loads:** Provide exterior metal fabrications that withstand design wind pressure calculated according to Uniform Building Code (UBC), 1997 Edition, Exposure C, Basic Wind Speed 130 Km/hr.
    - c. **Thermal Movements:** Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
      - 1) Temperature Change (Range): 35 deg C, ambient; 65 deg C, material surfaces.
- B. The design shall ensure that all components including anchors and connections shall comply with the allowable stresses as per relevant ASTM Standards. Load combinations shall be chosen to ensure that no element shall exceed the allowable stresses under any case of loading.

#### 2.1.4. SUBMITTALS

- a. **Product Data:** for non-slip aggregates and non-slip aggregate surface finishes, cast nosings, treads and thresholds, steel floor plate, paint products, and grout.
- b. **Shop Drawings:** Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
  - i. Provide templates for anchors and bolts specified for installation under other Sections.
- c. Samples representative of materials and finished products as may be requested by Engineer.

- d. **Mill Certificates:** Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- e. Welding Certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- f. **Qualification Data:** For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects/engineers and owners, and other information specified.

#### 2.1.5. QUALITY ASSURANCE

- a. **Quality System:** Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.
- b. **Fabricator Qualifications:** A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units, without delaying the work.
- c. **Engineering Responsibility:** Engage a fabricator who utilizes a qualified and experienced structural engineer to prepare design calculations, shop drawings, and other structural data.
- d. **Welding:** Qualify procedures and personnel according to the following:
  - i. AWS D1.1, "Structural Welding Code--Steel."
  - ii. AWS D1.2, "Structural Welding Code--Aluminum."
  - iii. AWS D1.3, "Structural Welding Code--Sheet Steel."
  - iv. AWS D1.6, "Structural Welding Code--Stainless Steel."
  - v. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
  - vi. Qualification tests according to the Structural Steel Code of Practice Prevailing in the country or other international Code or standard may also be accepted by the Engineer.

#### 2.1.6. PROJECT CONDITIONS

- a. **Field Measurements:** Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - i. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

#### 2.1.7. COORDINATION

- a. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including

sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

## **2.3 CUSTOM STEEL DOOR AND FRAMES - GENERAL**

### **2.3.1 RELATED DOCUMENTS**

- A. Drawing and provision of the contract, including general and supplementary Conditions.

### **2.3.2 SUMMARY**

- A. This Section includes the following:
  - 1. Steel doors.
  - 2. Steel door frames.
  - 3. Fire-rated door and frame assemblies.
  - 4. Fire-rated window assemblies.
  - 5. Louvers in doors. Steel louvered door.
- B. Related Sections include the following:
  - 1. Section "Unit Block Masonry Assemblies" for building anchors into and grouting frames in masonry construction.
  - 2. 8.0 Section "Door Hardware" for door hardware and weather stripping.
  - 3. 8.0 Section "Glazing" for glass in doors.

### **2.3.3 PERFORMANCE REQUIREMENTS**

- A. **Fire-Rated Door Assemblies:** Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to the Consultant, for fire ratings indicated, based on testing according to NFPA 252.
  - 1. Test Pressure: Test at atmospheric pressure.
  - 2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
  - 3. Temperature-Rise Rating: If indicated, provide doors that have a temperature-rise rating of 250 deg C maximum in 30 minutes of fire exposure.
- B. **Fire Resisting Door Components:** All components of fire resisting doors and assemblies, including but not limited to: door leaves, frames, ironmongery, hardware and glazing, shall carry identifying labels of an approved independent testing and inspection agency or laboratory, confirming their individual fire resistance rating. The rating of all door components shall be equal to the rating of the door assembly.
- C. **Fire Resisting Door Closers:** All fire resisting doors shall be fitted with door closers that automatically close and positively latch the door. In case of double-leaf doors, the closing system shall ensure that the inactive door leaf (door leaf with strike) closes first prior to active door leaf (door leaf with lock).

- D. Fire rated door assemblies that are tested and certified according to British Standard Specifications (BS) shall also be accepted.
- E. Weather Stripping: provide weather seals to all external doors.
- F. Smoke-Control Door Assemblies: Comply with NFPA 105.

#### 2.3.4 SUBMITTALS

- A. **Product Data:** Include construction details, material descriptions, core descriptions, label compliance, sound and fire-resistance ratings, and finishes for each type of door and frame specified.
- B. **Shop Drawings:** Show fabrication and installation of doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, dimensions of profiles and hardware preparation, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessories.
- C. **Door Schedule:** Submit schedule of doors and frames using same reference numbers for details and openings as those on Drawings.
  - 1. Coordinate glazing frames and stops with glass and glazing requirements.
- D. **Samples for Initial Selection:** Manufacturer's color charts showing the full range of finishes or colors available for units with factory-applied color finishes.
- E. **Samples for Verification:** For each type of exposed finish required, prepared on Samples not less than 75 by 125 mm (3" x 5") and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
- F. **Construction Samples:** Approximately 300 by 300 mm, (12" x 12") representing the required construction of doors and frames for Project.
  - 1. Doors: Show vertical-edge, top, and bottom construction; insulation; face stiffeners; and hinge and other applied hardware reinforcement. Include louver section and glazing stops if applicable.
  - 2. Frames: Show profile, welded corner joint, welded hinge reinforcement, dust-cover boxes, floor and wall anchors, stops, and silencers. Include panel and louver sections and glazing stops if applicable.
- G. **Product Certificates:** Signed by manufacturers of doors certifying that products furnished comply with or exceed the acceptance criteria of ANSI A250.4 for Level A doors.
- H. **Oversize Construction Certification:** For door assemblies required to be fire rated and exceeding limitations of labeled assemblies, submit certification of a testing agency acceptable to authorities having jurisdiction that each door and frame assembly has been constructed to comply with design, materials, and construction equivalent to requirements for labeled construction.

### 2.3.5 QUALITY ASSURANCE

- A. **Quality System:** Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing custom steel doors and frames similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. **Mockups:** Before installing custom steel doors and frames, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
  - 1. Build mockups in the location indicated or, if not indicated, as directed by Consultant.
  - 2. Build mockups for each custom steel doors and frames, and anchorage system components.
  - 3. Notify Consultant seven days in advance of dates and times when mockups will be constructed.
  - 4. Obtain Consultant's approval of mockups before fabricating custom steel doors and frames.
  - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### 2.3.6 WARRANTY

- A. **Door Manufacturer's Warranty:** Provide written Warranty, signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that do not fulfill quality and performance requirements or do not comply with tolerances in referenced quality standard such as, but not limited to:
  - 1. Structural failures.
  - 2. Faulty operation of movable parts and hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- B. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
  - 1. Warranty Period: Three years from date of Substantial Completion.

### 2.3.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver doors and frames palleted, wrapped, or crated to provide protection during transit and Project site storage. Do not use nonvented plastic.
- B. Inspect doors and frames, on delivery, for damage. Minor damage may be repaired provided refinished items match new work and are approved by Consultant; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames under cover at building site. Place units on minimum 100-mm- high wood blocking. Avoid using nonvented plastic

or canvas shelters that could create a humidity chamber. If wrappers on doors become wet, remove cartons immediately. Provide minimum 6-mm spaces between stacked doors to permit air circulation.

## PRODUCTS

### 2.3.8 MATERIALS

- A. **Metallic-Coated Steel Sheets:** ASTM A 653/A 653M, CS (commercial steel), Type B; with Z180 zinc (galvanized) or ZF180 zinc-iron-alloy (galvannealed) coating.
- B. **Inserts, Bolts, and Fasteners:** Manufacturer's standard units. Where items are to be built into exterior walls, zinc coat according to ASTM A 153/A 153M, Class C or D as applicable.

### 2.3.9 DOORS

- A. **General:** Provide flush-design doors, minimum 44 mm thick, (1<sup>3</sup>/<sub>4</sub>" ) of seamless construction, unless otherwise indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges.
  - 1. Visible joints or seams around glazed or louvered panel inserts are permitted.
  - 2. For single-acting swing doors, bevel both vertical edges 3 mm (2/16") in 50 mm (2").
  - 3. For double-acting swing doors, round vertical edges with 54-mm (2<sup>1</sup>/<sub>4</sub>" ) radius.
- B. **Metallic Core Construction:** Provide the following core construction welded to both door faces:
  - 1. Steel-Stiffened Core: Galvanized steel vertical stiffeners extending full-door height, spaced not more than 150 mm apart and spot welded to face sheets a maximum of 150 mm (16") o.c. Fill spaces between stiffeners with rockwool insulation of minimum 96.00 kg/cu. m (2.72 kg/cft) density applied to inside surfaces of face sheets.
  - 2. Use for all doors internal and external.
  - 3. Thickness of vertical stiffeners shall be equal to or more than thickness of door skins
- C. **Fire Door Cores:** As required to provide fire-protection and temperature-rise ratings indicated.
- D. **Astragals:** As required by NFPA 80 to provide fire ratings indicated. Comply with requirements specified in 8.0 section "Hardware"
- E. **Top and Bottom Channels:** Spot weld metal channel not less than thickness of face sheet to face sheets not more than 150 mm o.c.(6")
  - 1. Reinforce tops and bottoms of doors with inverted horizontal channels of same material as face sheet so flanges of channels are even with bottom and top edges of face sheets.
  - 2. For exterior doors, close bottom edge with metallic-coated steel closing channel and top edge with filler channel of same material, so webs of channels are flush with bottom and top door edges.

- F. **Hardware Reinforcement:** Fabricate reinforcing plates from the same material as door to comply with the following:
  - 1. Hinges and Pivots: 4.2 mm (1/8") thick by 38 mm (1.5") wide by 150 mm (6") longer than hinge, secured by not less than 6 spot welds.
  - 2. Lock Face, Flush Bolts, Closers, and Concealed Holders: 2.3 mm (1/16") thick.
  - 3. All Other Surface-Mounted Hardware: 1.3 mm (1/16") thick.
- G. **Interior Doors:** Fabricate face sheets of doors from two 1.30-mm- (2/32") thick metallic-coated, cold-rolled, stretcher-leveled steel sheets and other metal components from hot- or cold-rolled steel sheets.
- H. Thickness of face sheets for fire rated interior doors shall be as recommended by manufacturer to obtain fire rating indicated, but not less than 1.30 mm (2/32").
- I. Thickness of face sheets for interior steel doors to receive armor plates shall be 1.60 mm.
- J. **Exterior Steel Doors:** Fabricate face sheets of doors from two 1.6-mm- (3/32") thick, stretcher-leveled, metallic-coated steel sheets. Provide weep-hole openings in bottom of doors to permit entrapped moisture to escape. Seal joints in top edges of doors against water penetration.

#### 2.3.10 FRAMES

- A. Fabricate frames of full-welded unit construction, with corners mitered, reinforced, and continuously welded full depth and width of frame. Knockdown frames are not acceptable.
  - 1. For exterior use, form frames from 2.00-mm- (4'-0") thick, metallic-coated cold-rolled steel sheets.
  - 2. For interior use, form frames from metallic-coated cold-rolled steel sheet of the following thicknesses:
    - a) Openings up to and including 1200 mm (48") Wide: 1.60 mm (3/32").
    - b) Openings More Than 1200 mm (48") Wide: 1.7 mm (3/32").
- B. **Hardware Reinforcement:** Fabricate from same material as frame. Minimum thickness of steel reinforcing plates for the following hardware:
  - 1. Hinges and Pivots: 4.2 mm (1/8") thick by 38 mm (1.5") wide by 150 mm (6") longer than hinge, secured by not less than 6 spot welds.
  - 2. Strikes, Flush Bolts, and Closers: 2.3 mm (2/8").
  - 3. Surface-Mounted Hold-Open Arms and Panic Devices: 2.3 mm (2/8").
- C. **Mullions and Transom Bars:** Provide closed or tubular mullions and transom bars where indicated. Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between frame members with concealed clip angles or sleeves of same metal and thickness as frame.
  - 1. Provide false head member to receive lower ceiling where frames extend to finish ceilings of different heights.
- D. **Head Reinforcement:** Where installed in masonry, leave vertical mullions in frames open at top for grouting.

- E. **Jamb Anchors:** Weld jamb anchors to frames near hinges and directly opposite on strike jamb as required to secure frames to adjacent construction.
  - 1. In-Place Concrete or Masonry: Anchor frame jambs with minimum 9-mm- (6/16") diameter concealed bolts into expansion shields or inserts 150 mm from top and bottom and 650 mm (26") o.c., unless otherwise indicated. Reinforce frames at anchor locations. Except for fire-rated openings, apply removable stop to cover anchor bolts, unless otherwise indicated.
- F. **Floor Anchors:** Provide floor anchors for each jamb and mullion that extends to floor, formed of same material as frame, 1.7 mm (3/32") thick, as follows:
  - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners, welded to bottom of jambs and mullions.
  - 2. Cement-Based Screeds: Adjustable type with extension clips, allowing not less than 50-mm height adjustment. Terminate bottom of frames at finish floor surface.
- G. **Head Anchors:** Provide 2 head anchors for frames more than 1066 mm (43") wide and mounted in steel-stud walls.
- H. **Head Strut Supports:** Provide 9-by-50-mm (6/16" x 12") vertical steel struts extending from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
- I. **Structural Reinforcing Members:** Provide as part of frame assembly, where indicated at mullions, transoms, or other locations to be built into frame.
- J. **Head Reinforcement:** For frames more than 1200 mm (48") wide in masonry wall openings, provide continuous steel channel or angle stiffener, 2.3 mm (2/8") thick for full width of opening, welded to back of frame at head.
- K. **Spreader Bars:** Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.
- L. **Rubber Door Silencers:** Except on weather-stripped doors, drill stop in strike jamb to receive three silencers on single-door frames and drill head jamb stop to receive two silencers on double-door frames. Install plastic plugs to keep holes clear during construction. Silencers shall be neoprene, UL-rated for fire doors.
- M. **Plaster Guards:** Provide 0.4-mm- thick plaster guards or dust-cover boxes of same material as frame, welded to frame at back of hardware cutouts to close off interior of openings and prevent mortar or other materials from obstructing hardware operation.
- N. External frames shall have continuous grooves along perimeter to **house weather stripping.**

### 2.3.11 LOUVERS

- A. **Door Louvers:** Fabricate louvers and mount flush into doors without overlapping moldings on surface of door face sheets. Provide internal support as recommended by louver manufacturer. Prime paint steel louvers after fabrication.



1. Interior Louvers: Sightproof, stationary type, constructed of inverted Y-shaped blades formed of same material as door.
  - a) Steel: 1.00 mm (2/32") thick.
- B. **Fire-Rated Automatic Louvers:** Sight proof louver inserts fabricated from 1.3-mm- thick (2/32") steel, spring operated, and released by 57 deg C fusible links listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by the same testing and inspecting agency that established fire-resistance rating of door assembly.

### 2.3.12 STOPS AND MOLDINGS

- A. Provide stops and moldings around solid, glazed, and louvered panels where indicated.
- B. Form fixed stops and moldings integral with frame, unless otherwise indicated.
- C. Provide removable stops and moldings where indicated or required, formed of 0.8-mm- thick steel sheets matching steel frames. Secure with countersunk flat or oval head machine screws spaced uniformly not more than 300 mm (12") o.c. Form corners with butted hairline joints.
- D. Coordinate rabbet width between fixed and removable stops with type of glass or panel and type of installation indicated.

### 2.3.13 FABRICATION

- A. Fabricate doors and frames rigid, neat in appearance, and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles. Weld exposed joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.
  1. Fabricate doors to comply with acceptance criteria of ANSI A250.4 for a Level A door.
- B. For doors with metallic core construction, weld cores to both door face sheets.
- C. For doors with nonmetallic core construction, laminate core material to both door face sheets with waterproof adhesive.
- D. **Exposed Fasteners:** Provide countersunk flat or oval heads for exposed screws and bolts, unless otherwise indicated.
- E. **Thermal-Rated (Insulating) Assemblies:** At exterior locations and elsewhere as shown or scheduled, provide doors and frames fabricated as thermal-insulating assemblies and tested according to ASTM C 236 or ASTM C 976.
  1. Provide thermal-rated assemblies with U-factor matching that of the assembly involving door.
- F. **Hardware Preparation:** Prepare doors and frames to receive hardware, including cutouts, reinforcement, mortising, drilling, and tapping, according to final hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 Series specifications for door and frame preparation for hardware.

1. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
  2. Locate hardware as indicated or, if not indicated, according to HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
- G. **Electrical Closets Doors:** Are to comply with the following requirements:
1. Doors are to be proprietary, labeled as one (1) hour fire resistance rated and complying with requirements specified in this Section.
  2. Frames are to be integral with sill to be anchored to underlying sill construction.

## **3 WOOD, PLASTIC AND COMPOSITE**

### **3.1- WOODEN DOORS**

#### **GENERAL SECTION**

##### **3.1.1 RELATED DOCUMENTS**

- A. Drawing and general provisions of the contract, including general and supplementary Conditions.

##### **3.1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Non-fire-rated flush wood doors of semi-solid core.
  - 2. Shop priming flush wood doors.
  - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
  - 4. Louvers for flush wood doors.
- B. Related Sections include the following:
  - 1.0 Section "Steel Doors and Frames" for steel frames to receive flush wood doors.
    - 1. Section "Door Hardware" hardware for flush wood doors.
    - 2. 8.0 Section "Glazing" for glass view panels in flush wood doors.
    - 3. 9.0 Section "Painting".

##### **3.1.3 SUBMITTALS**

- Product Data: For each type of door. Include details of core and edge construction, trim for openings, and louvers.
  - 1. Include factory-finishing specifications.
- A. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
  - 1. Indicate dimensions and locations of mortises and holes for hardware.
  - 2. Indicate dimensions and locations of cutouts.
  - 3. Indicate doors to be factory finished and finish requirements.
- B. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
  - 1. Faces of factory-finished doors with opaque finish. Show the full range of colors available.
- C. Samples for Verification: As follows:
  - 1. Corner sections of doors approximately 200 by 250 mm (8" x 10") with door faces and edgings representing the typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.
  - 2. Louver blade and frame sections, 150 mm (6") long, for each material and finish specified.
  - 3. Frames for light openings, 150 mm (6") long, for each material, type, and finish required.

#### 3.1.4 **QUALITY ASSURANCE**

Quality System: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

#### 3.1.5 **DELIVERY, STORAGE, AND HANDLING**

Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's written instructions.

- 1. Individually package doors in plastic bags or cardboard cartons.
- 2. Individually package doors in cardboard cartons and wrap bundles of doors in plastic sheeting.
- A. Mark each door with individual opening numbers used on Shop Drawings. Use removable tags or concealed markings.

#### 3.1.6 **PROJECT CONDITIONS**

Environmental Limitations: Do not deliver or install doors until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

- A. Environmental Limitations: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with requirements of the referenced quality standard for Project's geographical location.

#### 3.1.7 **WARRANTY**

Door Manufacturer's Warranty: Provide written Warranty, signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 6.5 mm (4/16") in a 1100-by-2100-mm (44" x 84") section or that show telegraphing of core construction in face veneers exceeding 0.25 mm in a 75-mm (3") span, or do not comply with tolerances in referenced quality standard.

- 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
- 2. Warranty shall be in effect during the following period of time after the date of Substantial Completion:
  - a) Semi-solid-core Interior Doors: Two years.

### **PRODUCTS**

#### 3.1.8 **WOODS, GENERAL**

- A. Woods shall be marked-on as Class-1 stocks which shall be properly treated, adequately seasoned and free from rot or insect attack, splits, shakes or checks, warping, twisting, chipping, loose knots and waming. Provide woods

of wane-free edges. Woods shall conform to the requirements of BS EN No. 942; plywood to BS EN No. 636.

- B. **Preservative Treatment:** All woods and plywood used shall be preservative treated. Application is to be carried out after cutting and machining, but before assembly, by a processor licensed by the treatment solution manufacturer. Solution strengths and treatment by pressure, vacuum or immersion process are to be selected to achieve service life and to suit wood treatability. Moisture content of wood at time of treatment is to be as specified for use in the work. After treatment, allow wood to dry before use. For each batch of wood, provide certificate of assurance that treatment has been carried out as specified.

C. **Softwoods**

1. Douglas Fir: Yellowish Brown wood of average intensity not less than 570 kg/m<sup>3</sup> (16.5 kg/cft) at 12% moisture content.
2. Whitewood: White/pale Yellowish Brown wood of average intensity of 470 kg/m<sup>3</sup> (13.32 kg/cft).
3. Or as directed by the Architect.

D. **Hardwoods**

1. White Oak Wood: Yellowish Brown, fine-grained wood of strong, compact, homogenous fibers and uniform texture. Average intensity shall not be less than 720 kg/m<sup>3</sup> (20.40 kg/cft) at 12% moisture content. Or as directed by the Architect.

E. **Plywood**

1. General: Shall be highest grade to BS EN 636, designated as veneer, with minimal imperfections as peeled. Moisture content shall not exceed 12%. Thickness shall be as specified. Employ plywood glued with INT glues to BS 1203.
2. Softwood Plywood: All layers shall be of softwood.
3. Hardwood Plywood: White Oak plywood; White-Oak veneer 0.90 mm thick minimum shall be factory hot-applied at exposed face of door, cut and match of veneer shall be selected by the Consultant.

3.1.9 **ACCESSORY MATERIALS**

Preservative treatment: Type listed in BS 1282 (except coal tar creosote) obtained from approved manufacturer to provide protection against termites and other destroying organisms.

- A. Adhesives: Close contact type to BS EN 301 or BS EN 302, suitable for the purpose and compatible with preservative treatment.

3.1.10 **NON-FIRE RATED SEMI-SOLID-CORE FLUSH WOOD DOORS**

**General:** Non-fire-rated flush wood doors shall be swinging-type side-hinged to jambs of frames with hand of doors as indicated on Drawings, fabricated to the general tolerances of BS No. 4787 and shall consist of a frame (door leaf frame) consisting of stiles and rails constructed of Douglas fir and a core constructed of a lower-density softwood (Whitewood). Core strips shall cover, at least, 67% of door leaf area (Semi-solid core).

- A. **Door Leaf Frame:** Stiles and rails shall be of dimensions as indicated on Drawings but in no case shall the width be less than 140 mm (5.50") for mortise stile or less than 100 mm for other stile and rails, before lipping. Door-leaf-frame components shall be continuously lipped at outer edges with 20 mm (3/4") thick lipping constructed of White Oak wood. Oak lipping shall be fixed to stiles and rails in continuous glued tongue-and-groove joints. Stiles, rails and lipping of door leaf frame shall be constructed in one piece, no jointing or splicing shall be permissible. Joints between stiles and rails shall be glued mortise-and-tenon.
- B. **Semi-Solid Cores:** Shall be horizontal rails of White wood, of uniform width. Ratio of solid to vacant shall be 2:1. Horizontal core rails shall be in one piece. Throughout door leaf height, at least, two horizontal core rails shall be mortise-and-tenon jointed and glued to stiles.
- C. **Facing:** Facing material shall be 6 mm (1/4") thick plywood glued with waterproof glue under pressure to both sides of core. Facing material shall extend flush and uniform, in both directions, between inner edges of lipping. Extend facing in one piece; no jointing or splicing shall be permissible. Type of facing material shall be as follows:
  - 1. Doors of Opaque Finish: Softwood plywood
- D. **Thickness of Doors:** Unless otherwise indicated on Drawings, finish thickness of flush non-fire-rated wood doors shall be 45 mm; (1¾") thickness of stiles, rails and core strips shall be 33 mm (1.5") and 45 mm (1¾") wood lipping.

### 3.1.11 LOUVERS AND LIGHT FRAMES

Metal Louvers: As follows:

- 1. Blade Type: Vision proof, inverted V.
- 2. Metal and Finish: Extruded aluminum with clear anodic finish, 25micron thick minimum.

### 3.1.12 HARDWARE

Hardware shall be as indicated in Hardware Sets and Door Schedule and as specified in 8.0, Section "Door Hardware".

### 3.1.13 FABRICATION, GENERALLY

Flush wood doors shall be fabricated in accordance with details shown on Drawings, requirements of this Section, general tolerances of BS No. 4787 and other in-contradicting requirements of BS No. 1186: Part 2.

- A. Carefully plan and layout the work to erect wood doors and to accommodate the work of other trades.
- B. Finish wood shall be smoothly dressed and sanded prior to assembly of door inner frames and shall be free from open joints, hammer and machine marks and other defects or surface blemishes.
- C. Re-treat all treated wood which is sawn along the length, ploughed, thickness, planed or otherwise extensively processed. Treat wood surfaces exposed by minor cutting and drilling with two flood coats of solution recommended for the purpose by the treatment solution manufacturer.
- D. Finish and cut wood at exact dimensions as required. Stile and rails shall be connected only in glued mortise-and tenon joints with horizontal core strips assembled and jointed at their locations between rails, along stiles. The resulting frame shall be robust, firm and square.

- E. Facing material shall be glued to core and frame. No nail-fixing exposed or concealed, for facing material shall be permissible. The assembly shall be glued under pressure with waterproof casein glue and be thoroughly dried and seasoned.
- F. Join lipping at outer perimeter of frame in continuous tongue-and-groove joints with glue.
- G. Factory machine doors for hardware that is not surface applied. Locate hardware as indicated on approved shop drawings. Comply with final hardware schedules, door frame shop drawings, and hardware templates.
  - 1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- H. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Louvers: Factory install louvers in prepared openings.

#### 3.1.14 **SHOP PRIMING**

Doors for Opaque Finish: Shop seal faces and edge of doors including cutouts with one coat of wood primer specified in 9.0 Section "Painting."

### **PART 2 - EXECUTION**

#### 3.1.15 **EXAMINATION**

- A. Examine installed door frames before hanging doors.
  - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
  - 2. Reject doors/ frames with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.1.16 **INSTALLATION**

Hardware: For installation, see 8.0 Section "Door Hardware."

- A. Manufacturer's Written Instructions: Install wood doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
- B. Job-Fit Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer. Machine doors for hardware. Seal cut surfaces after fitting and machining.
  - 1. Clearances: Provide 3.2 mm (4/32") at heads, jambs, and between pairs of doors. Provide 3.2 mm (4/32") from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 6.4 mm (4/16") from bottom of door to top of threshold.
  - 2. Bevel non-fire-rated doors 3-1/2 degrees at lock and hinge edges.
- C. Field-Finished Doors: Refer to the following for finishing requirements:
  - 1. 9.0 Section "Painting."

**3.1.17 ADJUSTING AND PROTECTING**

Operation: Re-hang or replace doors that do not swing or operate freely.

- A. Protect doors as recommended by door manufacturer to ensure that wood doors are without damage or deterioration at the time of Substantial Completion by the Employer.



## **3.2- ACCESS DOORS AND FRAMES**

### **GENERAL**

#### **3.2.1.1 RELATED DOCUMENTS**

- A. Drawing and general provisions of the Contracts, including general and supplementary Condition.

#### **3.3.1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Wall access doors and frames.
  - 2. Recessed panels for ceramic tiles.
  - 3. Access panels for suspended gypsum board ceilings.
  - 4. Wood shaft access doors.
- B. Related Sections include the following:
  - 1. 4.0 Section "Unit Masonry Assemblies" for anchoring and grouting access door frames set in masonry construction.
  - 2. 6.0 Section "Rough Carpentry" for materials and workmanship requirements for wooden shaft access doors.
  - 3. 9.0 Section "Gypsum Board Assemblies" for access panels to be installed in suspended gypsum board ceilings.
  - 4. 9.0 Section "Ceramic Tiles" for ceramic tiles and adhesives.
  - 5. 9.0 Section "Painting".

### **SUBMITTALS**

- A. **Product Data:** For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.
- B. **Shop Drawings:** Show fabrication and installation details of doors and frames. Include plans, elevations, sections, details, and attachments to other Work.
- C. **Samples:** For each door face material, at least 75 by 125 mm (3" x 5") in size, in specified finish.

### **QUALITY ASSURANCE**

- A. **Source Limitations:** Obtain each type of doors and frames through one source from a single manufacturer.
- B. **Fire-Rated Access Doors and Frames:** Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are labeled and listed by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. NFPA 252 for vertical access doors.
- C. **Size Variations:** Obtain Engineer's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

## COORDINATION

- A. **Verification:** Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

## PRODUCTS

### 3.3.1.6 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with ZF180 zinc-iron-alloy (galvannealed) coating or Z180 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.
- C. **Plaster Bead:** Casing bead formed from 0.75-mm (1/32") zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

### 3.3.1.7 PAINT

- A. **Shop Primers:** Provide primers that comply with 9.0 Section "Painting."
- B. **Shop Primer for Metallic-Coated Steel:** Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.
- C. **Galvanizing Repair Paint:** High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.
- D. **Epoxy paint:** Provide primers that comply with 9.0 Section "Painting."

### 3.3.1.8 ACCESS DOORS AND FRAMES

- A. Flush, Insulated, Fire-Rated Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.
  - 1. Locations: wall surfaces.
  - 2. Fire-Resistance Rating: As indicated on Drawings.
  - 3. Temperature Rise Rating: 139 deg C at the end of 30 minutes.
  - 4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 1.5 mm (2/32").
  - 5. Frame: Minimum 1.5-mm (2/32") thick sheet metal with plaster bead.
  - 6. Hinges: Concealed pin type.
  - 7. Lock: Key-operated cylinder lock, specified in 8.0 Section "Door Hardware".
- B. **Recessed Panels for Ceramic tiles:** Units consisting of frame with expansion casing bead, door, hardware and complying with the following requirements:
  - 1. Frame: Zinc-coated steel sections and shapes.
  - 2. Plaster casing Bead: 0.76 mm (1/32") zinc coated steel casing bead with flange formed out of expanded metal lath.
  - 3. Panel: 2 mm (2/32") zinc coated steel sheet.
  - 4. Finish: Ceramic wall tiles matching adjacent walls adhered with water cleanable epoxy-based adhesive.
  - 5. Hardware: Nickel-plated steel hinges, exposed type and self-latching bolt operated with knurled knob.
- C. **Heavy Duty Gypsum Board Ceiling Panels:** Heavy duty ceiling flush access panel with fully concealed steel frame and gypsum board inlay fastened to door.

1. Material: Removable spring-loaded door, integrated safety catches, patented concealed nylon hinge mechanism, rounded or square corners as directed, formed galvanized frames, stainless steel springs, zinc-plated fasteners, self-adhesive rubber gasket and accessories. Frame shall be two-part type fixed to opening edges and recessed door gypsum board inlay.
2. Latch: Tamper-resistant cam latch.

Sizes: As indicated on Drawings.

#### 3.3.1.9 SHAFT ACCESS DOOR

- A. **Doors:** Solid core from approved softwood. 3 mm (2/16") thick plywood facing and hardwood lipping.
- B. **Frame:** Fabricate from preservative treated hardwood. Joints between stile and rail shall be single dove tail joints. Protect frame surfaces in contact with masonry with approved bitumen-based cold-applied protection coating.
- C. **Anchors:** Type suitable for fixing into concrete or hollow concrete masonry with metal components fabricated from corrosion-resistant material. Use minimum two anchors per each frame jamb or sill.
- D. **General:** Comply with requirements of Sections "Rough Carpentry" and "Flush Wood Doors" for preservative treatment and general workmanship requirements
- E. **Finishing:** Field-applied approved paint type of color selected by Engineer.

#### 3.3.1.10 FABRICATION

- A. **General:** Provide access door assemblies manufactured as integral units ready for installation.
- B. **Metal Surfaces:** For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. **Steel Doors and Frames:** Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
  1. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
- D. **Latching Mechanisms:** Furnish number required to hold doors in flush, smooth plane when closed.
  1. For cylinder lock, furnish two keys per lock and key all locks alike.
  2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

#### 3.3.1.11 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

#### 3.3.1.12 METALLIC-COATED STEEL FINISHES

- A. **Galvanizing of Steel Shapes and Plates:** Hot-dip galvanize items indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
  2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. **Surface Preparation:** Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited to the organic coating to be applied over it. For metallic-coated surfaces, clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
1. **Galvanizing Repair Paint:** High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.
- C. **Factory Priming for Field-Painted Finish:** Apply shop primer immediately after cleaning and pre-treating.

## EXECUTION

### 3.3.1.13 PREPARATION

- A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

#### 3.3.1.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install access doors with trim less frames flush with adjacent finish surfaces or recessed to receive finish material.
- D. Installation of fire-rated access doors and panels shall maintain same applicable requirements of Standards referenced for installation of fire-rated steel frames in 8.0 Section "Custom Steel Doors and Frames".

#### 3.3.1.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

### **3.3- RIOUGH CARPENTRY**

#### **GENERAL - RELATED WORK**

1. Architectural Wood Work
2. Gypsum Board System

##### **3.3.1.1 THIS SECTION INCLUDES**

This Section specifies incidental rough carpentry required for support or attachment of other construction and not specified in other sections and includes, but is not limited to, the following items:

- a. Wood grounds, blockings, nailers.
- b. Temporary and permanent grounds, blockings and supports required by other trades.

##### **3.3.1.2 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.
  1. Wood grounds, nailers, and blocking.
  2. Wood furring.
  3. Wood sub-frames.

##### **3.3.1.3 PRESERVATIVE TREATMENT**

- a. Application is to be carried out after cutting and machining, but before assembly, by processor licensed by the treatment solution manufacturer.
- b. Solution strengths and treatment by pressure, vacuum or immersion process are to be selected to achieve service life and to suit wood treatability.
- c. Moisture content of wood at time of treatment is to be as specified for use in the work.
- d. After treatment, allow wood to dry before use.
- e. For each batch of wood, provide certificate of assurance that treatment has been carried out as specified.
- f. Re-treat all treated wood which is sawn along the length, ploughed, thickened, planed or otherwise extensively processed.
- g. Treat wood surfaces exposed by minor cutting and drilling with two flood coats of solution recommended for the purpose by the treatment solution manufacturer.

##### **3.3.1.4 SUBMITTALS**

- a. Samples of all materials used in the work of this Section.
- b. Shop drawings for furring including details, sizes of wood sections, panel, spacings and method of attachment.

### 3.3.1.5 **QUALITY ASSURANCE**

- A. **Quality System:** Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.

### 3.3.1.6 **DELIVERY, STORAGE AND HANDLING**

Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

## **PRODUCTS**

### **TIMBER**

- a. Timber shall be well seasoned and free from decay, insect attack except pinhole borers,  
and knots wider than half of the width of the section.
- b. Timber shall be kiln dried to a maximum moisture content of 12% by weight.
- c. Timber required to be treated with preservatives or fire retardant shall be seasoned and kiln dried before treatment, and re-dried after treatment.
- d. Softwood shall be free from decay and insect attack, except pinhole borers, with  
no knots wider than half the width of the section. Softwood shall comply with BS EN 942 softwood species to be used in external locations are to be recommended for the purpose.
- e. Hardwood shall comply with BS EN 942. Hard wood to be used in internal locations are to be recommended for the purpose.
  1. Wood used for exterior applications or for interior applications in wet areas shall be factory treated to prevent moisture absorption.

### **SOFTWOOD**

To be either:

- a. Douglas Fir (Standard Grade)
- b. European Redwood
- c. Or as suggested by the Architect.

### **HARDWOOD**

- a. Teakwood
- b. White American Oakwood
- c. Or as suggested by the Architect.

## **RIGID SHEETS**

### **3.3.1.7 MDF (Fire Resistance)**

- a. Medium density fiberboard's for fabric panels, 8-10mm thick.
- b. Strips of MDF around fabric panels edging.
- c. All MDF components to be fire resistant.

### **3.3.1.8 PLYWOOD**

- a. Plywood: BS EN 636: Part 1, face grade for general use. Bonding is to be to BS 1203, type WBP for external use and type MR or INT for internal use.
- b. Marine Quality Plywood: to BS 1088 and BS 4079, excluding plywood made from gaboon.

### **3.3.1.9 CORK BOARD**

Are to be pre-formed sheets that have been formed from clean granulated cork particles securely bound together by a synthetic resin of an insoluble nature. Minimum thickness of sheets is to be 25 mm (1"), width and length are to be as indicated on Drawings.

### **3.3.1.10 FASTNERS**

- a. Nails: to BS 1202, Part 1, 2 or 3 generally, but non-ferrous types to Parts 2 or 3 for external use.
- b. Wood Screws: to BS 1210 generally, but non-ferrous types for external use.
- c. Self-Tapping Screws: to BS 4174.
- d. Dowels: mild steel, 10 mm (1/2") diameter, 100 mm (4") long, galvanized to BS EN ISO 1461 after fabrication.
- e. Cramps: mild steel, 25 x 3 x 250 mm (1" x 2/16" x 10") girth, turned up at one end and twice drilled for 3 mm (2/16") screws, fish-tailed at other end for building in and galvanized to BS 729 after fabrication.
- f. Plugs: either traditional hardwood plugs, shaped to twist and grip when driven, or proprietary fibre or plastics plugs, or other approved type.

### **3.3.1.11 TREATMENTS, ADHESIVE AND FINISHES**

- a. Preservative Treatment: shall be type listed in BS 1282 (except coal tar creosote), obtained from an approved manufacturer, to give suitable protection against termites and other wood destroying organisms.
- b. Adhesive for Joinery: shall be close contact type to BS EN 301 or BS EN 302 suitable for the purpose. Obtain manufacturer's confirmation that adhesive is compatible with preservative treatment.

## **EXECUTION**

### **3.3.1.12 INSTALLATION, GENERAL**

- a. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- b. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.

- c. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- d. Apply field treatment to cut surfaces of preservative-treated lumber and plywood.
- e. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.
- f. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
- g. Use hot-dip galvanized nails.
- h. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

**3.3.1.13 WOOD GROUNDS, NAILERS, BLOCKING AND SLEEPERS**

- a. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- b. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- c. Install permanent grounds of dressed, preservative-treated, key-beveled lumber not less than 1-38 mm wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

**3.3.1.14 WOOD FURRING**

- a. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- b. Firestop furred spaces of walls at each floor level and at ceiling with wood blocking or noncombustible materials, accurately fitted to close furred spaces.
- c. Furring to Receive Wood or Plastic Sheets or Boards: Install 19-by-63-mm actual-size furring at 600 mm o.c., horizontally and vertically. Select furring with no knots capable of producing bent-over nails and damage to paneling.
- d. Furring to Receive Gypsum Board: Install 19 (3/4")-by-38-mm (1½") actual-size furring at 400 mm (16") o.c., vertically.
- e. Furring to Receive Plaster Lath: Install 19 (3/4")-by-38-mm (1½") actual-size furring at 400 mm (16") o.c., vertically.



### **3.4- INTERIOR ARCHITECTURAL WOODWORK**

#### **GENERAL**

##### **3.4.1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

##### **3.4.1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Pantry cupboard.
  - 2. Laboratory bench.
  - 3. Vanities constructed from solid surfacing.
  - 4. Wood base.
- B. Related Sections include the following:
  - 1. 6.0 Section "Rough Carpentry".
  - 2. 9.0 Section "Painting" for field finishing of interior architectural wood works components that need finishing.

##### **3.4.1.3 SUBMITTALS**

- A. **Product Data:** For each type of product indicated, including finishing materials and processes.
  - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. **Shop Drawings:** Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
  - 1. Show details full size.
  - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  - 3. Show locations and sizes of cutouts and holes for items installed in architectural woodwork.
- C. **Samples for Initial Selection:** Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
  - 1. Shop-applied transparent finishes.
  - 2. Solid-surfacing materials.
- D. **Samples for Verification:** For the following:
  - 1. Solid-surfacing materials, 150 mm (6") square.
  - 2. Pantry hardware.
  - 3. Plastic-laminate-clad panel products, 200 by 250 mm, (8" x 10") for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
- E. **Product Certificates:** Signed by suppliers of used woods and rigid sheets certifying that products comply with requirements specified.

#### 3.4.1.4 **QUALITY ASSURANCE**

- A. **Installer Qualifications:** An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Fabricator Qualifications:** A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. **Source Limitations:** Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork.

#### 3.4.1.5 **PROJECT CONDITIONS**

- A. **Field Measurements:** Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

#### 3.4.1.6 **COORDINATION**

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

### **PRODUCTS**

#### 3.4.1.7 **WOOD**

- A. Softwood shall be free from decay and insect attack, except pinhole borers, with no knots wider than half the width of the section. Softwood shall comply with BS EN 942 softwood species to be used in external locations are to be recommended for the purpose.
- B. Hardwood shall comply with BS EN 942. Hardwood to be used in the works are to be recommended for the purpose.
- C. Wood shall be treated to prevent absorption of moisture.
- D. Plastic Laminate: to BS EN 438, color and pattern as follows:
  - 1. Color and Pattern: Shall be selected by Engineer from manufacturer's full range of colors and patterns.
  - 2. Minimum Thickness: 1.20 mm (1/16").
  - 3. Where indicated, select plastic laminate type suitable for post forming application.

#### 3.4.1.8 **RIGID SHEETS**

- A. Plywood: BS EN 636: Part 1, face grade for general use. Bonding is to be to BS 1203, type WBP for external use and type MR or INT for internal use.

### 3.4.1.9 FASTENERS

- A. **Nails:** to BS 1202, Part 1, galvanized steel.
- B. **Wood Screws:** to BS 1210 generally, galvanized steel.
- C. **Self-Tapping Screws:** to BS 4174.
- D. **Dowels:** mild steel, 10 mm (1/2") diameter, 100 mm (4") long, galvanized to BS EN ISO 1461 after fabrication.
- E. **Cramps:** mild steel, 25 x 3 x 250 mm (1" x 1/32" x 10") girth, turned up at one end and twice drilled for 3 mm (1/32") screws, fish-tailed at other end for building in and galvanized to BS EN ISO 1461 after fabrication.
- F. **Plugs:** either traditional hardwood plugs, shaped to twist and grip when driven, or proprietary fiber or plastics plugs, or other approved type.

### 3.4.1.10 FIRE-RETARDANT-TREATED MATERIALS

- A. **General:** Where indicated, use materials impregnated with fire-retardant chemical formulations indicated by a pressure process or other means acceptable to Engineer to produce products with fire-test-response characteristics specified.
  - 1. Do not use treated material that does not comply with requirements of referenced woodworking standard or that is warped, discolored, or otherwise defective.
  - 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
- B. **Fire-Retardant-Treated Lumber and Plywood by Pressure Process:** Comply with BS 5589. Use the following treatment type:
  - 1. Type: Organic-resin-based formulation thermally set in wood by kiln-drying.
  - 2. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
  - 3. Kiln-dry material before and after treatment to levels required for untreated material.
- C. All lumber, wood, fir, plywood or boards used in the works of this Section are to be preservative and fire-retardant treated.

### 3.4.1.11 SOLID SURFACE MATERIAL

- A. **Solid-Surfacing Material for Counter Top:** Homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without a pre-coated finish.

### 3.4.1.12 INSTALLATION MATERIALS, GENERAL

- A. **Furring, Blocking, Shims, and Hanging Strips:** Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

### 3.4.1.13 FABRICATION, GENERAL

- A. **General:** Comply with requirements of BS 1186-2.
- B. **Wood Moisture Content:** Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

- C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- D. Fabricate woodwork to dimensions, profiles, and details indicated.
- E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Notify Engineer seven days in advance of the dates and times woodwork fabrication will be complete.
  - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- F. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- G. Fabricated; cabinets and similar items are to be of robust firm neat construction with:
  - 1. Shutters, sashes, drawers and other opening or moving parts working smooth without bound conditions.
  - 2. Clearance between sashes and between jambs and sashes uniform.
  - 3. Level horizontal surfaces and plumb vertical surfaces when installed.

#### 3.4.1.14 SHOP PRIMING

- A. **General:** Priming of interior architectural woodwork required to be performed at fabrication shop are specified in this Section. Refer to 9.0 Section "Painting" for final finishing of installed architectural woodwork and for priming materials to be used.
- B. **Preparations for Priming:** Comply with 9.0 Section "Painting" for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for priming woodwork, as applicable to each unit of work.
  - a. **Back-priming:** Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to end-grain surfaces.

#### 3.4.1.15 PANTRY CUPBOARD AND BENCHES

- A. Base counters and upper cabinets units shall be pre-fabricated units constructed to dimensions and details indicated on Drawings.
- B. Construct units from the following materials so as to have all exposed or semi-exposed surfaces of plastic laminate finish:
  - 1. 19 mm (3/4") thick plywood with post-formed plastic laminate finish at both faces for front doors, bottoms and top of upper cabinet and shelves.
  - 2. 19 mm (3/4") thick solid surfacing material with integral factory formed back splash top of base counter with integral back splash.
  - 3. 6 mm (2/8") thick plywood of plastic laminate finish at one face for units backs and drawer base.

4. 19 mm (3/4") thick plywood with post-formed plastic laminate finish for drawers front, sides and back
- C. Plastic laminate sheet veneers shall be as specified in Clause 2.1 of this Section, color and pattern to the selection of the Engineer. Units are to be assembled in manufacturer's standard system to provide neat and robust construction.
- D. Construct sole of base counter, consisting of perimeter sides and intermediate struts, from hardwood solid blocks and finish exposed fronts to match finish of surrounding floors.
- E. Provide metal pre-slotted shelf holders of baked enamel finish complete with removable brackets for shelf supporting. Color is to be to the selection of the Engineer.
- F. Provide manufacturer's standard hardware including hinges, drawer slides, latches and knobs of finish to the selection of the Engineer. All hardware shall be manufactured from stainless steel, alloy 304, of satin finish.
- G. Blocking wood shall be from approved hardwood type.
- H. Construct top of base cabinet units integral with coved back splash from solid surfacing material as specified. Color or colors shall be selected by the Engineer from manufacturer's full range. To the maximum possible extent provide seamless construction. Where seams are unavoidable, align adjacent solid surfacing-material units and factory form seams. Joints are to be dressed smooth with surface scratches removed and entire surface cleaned.

#### 3.4.1.16 WOOD BASES

- A. Are to be constructed from White Oak hardwood.
- B. Fabricate to dimensions and details indicated.
- C. Furnish in length as long as practice.
- D. Corners are to be mitered at 45 degrees.
- E. Finish of bases shall be transparent stained varnish as specified in section "Painting".

#### 3.4.1.17 VANITIES

- A. Furnish vanities pre-fabricated in the workshop from solid surfacing material. Color(s) shall be selected by the Engineer.
- B. Fabricate vanities to dimensions indicated on Drawings and details indicated on approved shop drawings. Comply with the following sheet thickness:
  - Vanity: 20.0 mm (3/4")
  - Aprons and backsplash: 13.0 mm (1/2").
- C. Provide seamless vanity construction with pre-opened holes for assembly of lavatories. Use approved samples of lavatories for fixing size of holes. Comply with manufacturer's printed instructions for fabrication of vanities.

### EXECUTION

#### 3.4.1.18 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.

#### 3.4.1.19 **INSTALLATION**

- A. **Quality Standard:** Install woodwork to comply with BS 1186-2 and details indicated on Drawings and approved shop drawings.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops).
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with recommendations of chemical treatment manufacturer, including those for adhesives used to install woodwork.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- F. Fix wood bases with pre-drilled, expansion-type wall plugs fabricated from hard nylon and galvanized-steel wood screws of suitable length and diameter at maximum intervals of 750 mm (30"). Counter sink heads of screws in wood and overfill with approved wood filler of matching color as adjacent finished stained wood.
- G. Refer to 9.0 Section "Painting" for final finishing of installed architectural woodwork components that need finishing.

#### 3.4.1.20 **ADJUSTING AND CLEANING**

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean woodwork on exposed and semi exposed surfaces.

END OF SECTION

### **3.4.1.21 GLASS AND GLAZING**

#### **GENERAL**

##### **3.4.1.21 DESCRIPTION**

A. Furnish labor, materials and equipment to supply and install glass in different types of windows and doors.

##### **3.4.1.22 SUBMITTALS**

A. Samples:

1. 300 x 300 mm (12 x 12 IN), of each specified type, class and thickness.
2. Sample of translucent ceramic fit pattern.

B. Project close-out information

1. Guarantee

##### **3.4.1.23 JOB CONDITIONS**

Do not proceed with installation under adverse weather conditions, or when temperature are below or above manufacturer's recommended limitations.

##### **3.4.1.24 STORAGE AND HANDLING:**

A. Store glazing in cases within building in a dry, well-ventilated area to avoid cyclic wetting and drying and damage from moisture.

B. Store glazing out of case vertically with interweaving or pacing between the individual lights

C. Protect glazing from welding operation, wind-blown objects, and run-off over alkaline materials.

D. Handle glazing carefully to prevent edge damage.

##### **3.4.1.25 GUARANTEE**

Written 5 year guarantee signed by installer to cover weather tightness of installation including air and water integrity. Guarantee structural adequacy of units and hardware, sealants and caulking within and around perimeter of installation.

#### **PRODUCTS**

##### **3.4.1.26 MATERIALS**

A. Glass materials.

1. Comply with specified standards
2. Manufacturer or fabricator is responsible for determining if any of these materials should be heat strengthened or fully tempered and provide accordingly.

B. Tinted glass for aluminum windows & doors

1. Tinted tempered float glass 6 or 8, 10 or 12 mm thick as produced by Pilkington or similar.

2. The following performance:

a- Visible light transmittance 71%

- b- Outdoor reflectance (%) 7%
- c- Total solar energy transmittance 33%
- d- Shading Coefficient 0.58%

C. Clear glass for windows and doors

- 1. Clear tempered float glass, 6 mm, 8 mm or 10 mm thick ASTM C1048.

D. Glazing compounds:

- 1. Non-sag, non-stain type.
- 2. Pigmented to match frame units not requiring painting.
- 3. Compatible with adjacent surfaces.
- 4. For use in setting glass: One part polyurethane or silicone sealant, F.S. TTS-00230C (2), Type II, class A or two-part polyurethane sealant, F.S. TT-S- 00227E, Type II, class A.
- 5. Sealant tape: Performed butyl 1 rubber sealant tape or ribbon having a continuous neoprene rubber shim.
- 6. Gaskets: Polyvinyl chloride or neoprene, extruded, flexible, of profile and hardness required to receive glass and provide a watertight installation.

A. Setting blocks and spacers: Neoprene, compatible with sealants used.

- 1. Setting blocks: 70 - 90 urometer
- 2. Spacers: 40-50 urometer
- 3. Compressible filler stock: closed-cell jacketed rod stock of synthetic rubber or plastic foam.

B. Shims clips, springs, angles, beads, attachment screws and other miscellaneous items: As indicated or required.

## **EXECUTION**

### **3.4.1.27 INSPECTION**

Examine framing or glazing channel surfaces, backing, stop design, and conditions under which glazing is to be performed.

### **3.4.1.28 INSTALLATION**

- A. Do not install glass with edge damage.
- B. Contractor is responsible for correct glass size for each opening, within tolerances and dimensions established.
- C. Comply with combined recommendation of material manufacturers, except where more stringent requirements are shown or specified.
- D. Install sealants as recommended by sealant manufacturer.
  - A. E. Install setting blocks in adhesive.
- F. Provide spacers inside and out, of proper size and spacing, for all glass sizes larger than 1270 united mm, except where gaskets are used for glazing. Provide 3.175 mm minimum bite of spacers on glass. Use thickness equal to sealant width. Use preshimmed tape, if tape is used.
- G. Miter cut and bond gasket ends together at corner. Do not stretch gaskets.
- H. Immediately after installation, attach crossed streamers to framing held away from glass. Do not apply anything to surfaces to glass.
- I. Remove, and replace damaged glass and provide new acceptable materials.



**3.4.1.29 CLEANING AND PROTECTION**

A. Maintain glass reasonably clean during construction, so that it will not be damaged by corrosive action and will not contribute to deterioration of other materials.

B. Wash and polish, glass on both faces not more than 7 days prior to Engineers acceptance of work in each area. Comply with glass manufacturer's recommendation.

END OF SECTION

### **3.5- TERMITE CONTROL**

#### **PART 1 – GENERAL**

- A. General provisions of the Contract, including Conditions of Contract apply to this Section.

#### **3.5.1. SUMMARY**

- A. This Section includes the following for termite control:
  1. Termite prevention
  2. Soil treatment
  3. Wood protection

#### **3.5.2. TERMITE PREVENTION**

- A. Avoid creation of conditions that invite termites wherever possible. Take the following measures:
  1. Remove stumps, roots, wood, and other cellulose materials from the building site before commencing construction.
  2. Remove cellulose materials from around the foundation before final backfill.
  3. Promptly remove form boards and grade stakes used in construction from site.
  4. Allow no contact between building woodwork and soil or fill material.
    - a) Locate exterior woodwork a minimum of 15 cm above ground and beams in crawl spaces at least 45 cm above ground to provide ample space to make future inspections.
    - b) Make foundation areas accessible for inspection if possible.
    - c) If wood that contacts the soil, such as fence posts and foundation elements, use pressure treated wood.
  5. Design ventilation openings in foundations to prevent dead air pockets and to help keep the ground dry.
  6. Direct water away from the structure through proper grading.
  7. Assure that the roof drainage system directs all water away from the foundation.
  8. Avoid plantings near the foundation. Any tree that has the potential to grow to a height of 12 meters or taller shall not be planted within 15 meters of the foundation.

#### **3.5.3. DEFINITIONS**

- A. EPA: United States Environmental Protection Agency.
- B. PMP: Pest Management Professional

#### **3.5.4. SUBMITTALS**

- A. Product Data: For termiticide and borate.
  1. Include the EPA-Registered Label for termiticide and borate products.
- B. Product Certificates: For termite control products, signed by product manufacturer.

- C. Qualification Data: For Installer of termite control products.
- D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:
  - 1. Date and time of application.
  - 2. Moisture content of soil before application.
  - 3. Brand name and manufacturer of termiticide.
  - 4. Quantity of undiluted termiticide used.
  - 5. Dilutions, methods, volumes, and rates of application used.
  - 6. Areas of application.
  - 7. Water source for application.
- E. Wood Treatment Application Report: After application of borate is completed, submit report for Owner's record information, including the following:
  - 1. Date and time of application.
  - 2. Brand name and manufacturer of borate.
  - 3. Quantity of undiluted borate used.
  - 4. Dilutions, methods, volumes, and rates of application used.
  - 5. Areas of application.
- F. Warranty: Special warranty specified in this Section.

#### 3.5.5. **QUALITY ASSURANCE**

- A. Applicator Qualifications: A PMP who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.
- B. Regulatory Requirements: Formulate and apply termiticide, and label with a US EPA registration number, to comply with EPA regulations and authorities having jurisdiction.
- C. Document any applicable local codes or authorities and ensure that all relevant work is in compliance.
- D. Implement applicable provisions of the Quality Control program as established in:
  - Section 01401, "Contractor Quality Control."

#### 3.5.6. **PROJECT CONDITIONS**

##### TERMITE CONTROL SECTION 02361 - 3

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

#### 3.5.7. **COORDINATION**

- A. Coordinate soil treatment application with excavating, filling, and grading and

concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

### 3.5.8. **WARRANTY**

- A. Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, retreat soil and repair or replace damage caused by termite infestation.
- B. Warranty Period: Five years from date of Substantial Completion.

## **PART 2 – PRODUCTS**

### 3.5.9. **TERMITICIDES**

- A. Soil Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or amusable, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation for review and acceptance by the COR.
  - 1. The Department of State currently authorizes Termidor and Premise as soil termiticide.
  - 2. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA Registered Label.
- B. Wood Protection Termiticide:
  - 1. Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation for review and acceptance by COR.
  - 2. The Department of State currently authorizes Timber and Bora Care for preventive wood treatment.
  - 3. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA Registered Label.
  - 4. Protect vegetation from contact with Timber and Bora Care.

END OF SECTION

# **Technical Specifications**

## **Plumbing Works**

**(Specifications for Non-Schedule items  
only. For Schedule Items PWD 2012  
Specifications shall prevail)**

(Sect. 15140) -	DOMESTIC WATER PIPING
(Sect. 15145) -	DOMESTIC WATER PIPING SPECIALTIES
(Sect. 15150) -	SANITARY WASTE, VENT AND STORM PIPING
(Sect. 15155) -	DRAINAGE PIPING SPECIALTIES
(Sect. 15410) -	PLUMBING FIXTURES
(Sect. 15441) -	PLUMBING PUMPS

**Sect.15140 - DOMESTIC WATER PIPING**

## PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

## 1.02 SUMMARY

- A. This Section includes domestic water piping inside the building.

## 1.03 DEFINITIONS

- A. CPVC: Chlorinated polyvinyl chloride plastic.
- B. PEX: Crosslinked polyethylene plastic.
- C. PVC: Polyvinyl chloride plastic.
- D. PPR: Poly propylene Random

## 1.04 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with 125 psig (860 kPa) unless otherwise indicated.

## 1.05 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Water Samples:
- C. Field quality-control test reports.

## 1.06 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic, potable domestic water piping and components

- C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Refer Approved List of Manufacturers.

### 2.02 PIPING MATERIALS

- A. The pipe materials shall as stated below.

### 2.03 DOMESTIC COLD WATER BELOW AND ABOVE GRADE

- 1. Polypropylene pipes and pipe fitting PN20 to DIN 8077 for pipe size upto 110mm dia.
- 2. uPVC pipes to BS 3505 with Class E with solvent welded fittings to BS 4346 for pipe sizes above 110mm dia.

### 2.04 DOMESTIC HOT WATER PIPING

- 1. Polypropylene pipes and pipe fitting PN20 to DIN 8077 for pipe size upto 110mm dia.
- 2. cPVC Sch 80 pipes with solvent welded fittings for pipe sizes above 110mm dia.

### 2.05 IRRIGATION PIPES

- 1. uPVC pipes to BS 3505 with Class E with solvent welded fittings to BS 4346 for all pipe sizes.

### 2.06 VALVES

- A. Generally, all valves of the same type shall be of the same manufacturer. All gate, globe, angle, and swing check valves as a group shall be of the same manufacturer. All valves 50 mm and smaller shall be threaded and have bronze bodies.
- B. All valves 65 mm and larger shall be Cast iron type and shall be flanged (or grooved for grooved coupling joints).



- C. For PPR piping use PPR Coated valves of the same piping material and manufacturer.
- D. Each valve shall be marked (engraved, stamped, or cast on each valve or metal tag, permanently attached to the valve) at the factory with the following minimum information
  - 1. Manufacturer's Name.
  - 2. Catalogue or Figure No.
  - 3. Size and Pressure Class.
- E. Arrows to indicate direction of flow on check, globe, angle, non-return, and eccentric plug valves.

#### 2.07 GATE VALVES

- A. [Size 50 mm and Smaller]. Furnish bronze valves with screwed-in bonnet, non-rising stem, solid wedge disc, and threaded ends. Pressure rating PN20.
- B. [Size 65 mm and Larger]. Furnish Iron Body Bronze Mounted (IBBM) valves, i.e. cast iron body bronze trim valves, with bolted bonnet, non-rising stem, solid wedge disc, flanged ends, and renewable seat rings.

#### 2.08 GLOBE VALVES.

- A. [Size 50mm and Smaller]. Furnish valves designed for minimum PN20 working pressures.
- B. [Size 65 mm and Larger]. Furnish valves designed for minimum PN16 working pressure.

#### 2.09 CHECK VALVES

- A. [50 mm and smaller]. Furnish swing valves designed for minimum PN20 non-shock working pressures. Valves shall have renewable discs and side plugs, integral seats.
- B. [Size 65 mm and Larger Water Check Valves]. Valves shall be silent type spring loaded of the double door or wafer style. Valves shall be designed for minimum PN16 non shock water working pressure.

#### 2.010 RELIEF VALVES.

Domestic Water Temperature and Pressure Relief Valve.

- A. On hot water storage tanks provide an ASME rated thermostatic, self-closing, temperature and pressure relief valve, located in the relief valve openings of tanks. Valve shall have a minimum thermal discharge capacity equal to the input capacity of the heater standard pressure setting of 600 kPa and standard temperature setting of 100 - 140 degrees C. Relief valve pipe to discharge to floor drain.

## 2.011 BALL VALVES.

- A. [Size 50 mm and Smaller]. Valves shall be standard port, 2-piece construction with screwed ends. Valves shall be designed for minimum PN25. Valves shall have bronze or brass body, stainless steel ball, steel handle with vinyl grip.
- B. [Size 65 mm and Larger]. Valves shall be standard port, BS 5159 with flanged ends. Valves shall be designed for minimum PN16 working pressure. Valves shall have steel body, chrome or nickel plated steel or stainless steel ball.

## 2.012 Float Valves

- A. Float valves shall be installed as indicated in the drawings to provide consistent level control in reserve supply water storage tanks. The valve shall meet the requirements of the Water Byelaws for air gaps and shall be constructed throughout in approved materials and shall prevent back siphoning. Bronze equilibrium float valves 80 and above shall be flanged end, flat faced and drilled to suit BS4504 PN16.
- B. Bronze equilibrium float valves upto 50 shall be screwed end BS2779 parallel and shall be provided complete with back nut.
- C. Floats for valve sizes 80mm and above shall be of copper.

## 2.013 Solenoid Valves

- A. Electrically operated solenoid valves shall be single phase 220V and shall be rated for the system pressure

## 2.014 Bib Taps

- A. Bib-cocks shall be in accordance with BS 1010: 1973. They shall be provided with hose union nosepiece and hand wheel operated.

## 2.015 Automatic Air Valves

- A. Automatic air valves shall have a bronze body with bolted cover and a 9mm top outlet.

## 2.016 Strainers

- A. Up to and including DN50 strainers shall be manufactured from bronze and shall be of the 'Y' type with bolted cap, PN25 temperature/pressure rating.
- B. Strainers above DN50 shall be manufactured from cast iron and shall be of the 'Y' type with bolted cap, PN16 temperature/pressure rating and shall be complete with drilled and tapped caps complete with drain cocks.

- C. Strainers shall be provided with a medium grade screen sized such that in their clean condition the maximum pressure drop at the design flow rate shall not exceed 6kPa.

### PART 3 - EXECUTION

#### 3.01 EXCAVATION

- A. Excavating, trenching, and backfilling are specified in Section "Earthwork."

#### 3.02 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Grooved joints may be used on aboveground grooved-end piping.

#### 3.03 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
  - 2. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
  - 3. Drain Duty: Hose-end drain valves.
- B. PPR Coated PN-25 rated ball, butterfly, and check valves may be used in matching piping materials.

#### 3.04 PIPING INSTALLATION

- A. Install domestic water piping level without pitch and plumb.
- B. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

#### 3.05 HANGER AND SUPPORT INSTALLATION

- A. Install supports according to Division 15 Section "Hangers and Supports."
- B. Support vertical piping and tubing at base and at each floor.

- C. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
- D. Install hangers for PVC/cPVC/PPR and PE piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 2 (DN 50) and Smaller: 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
  - 2. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
  - 3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
  - 4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
  - 5. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
- E. Install supports for vertical PVC/cPVC/PPR piping every 48 inches (1200 mm).

### 3.06 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
  - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
  - 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
    - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
  - 3. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as follows:
  - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 4. Cap and subject piping to water pressure of 150 psi or 50 psi above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

**END OF SECTION 15140**

**Sect.15145 - DOMESTIC WATER PIPING SPECIALTIES**

## PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions Specification Sections, apply to this Section.

## 1.02 SUMMARY

- A. This Section includes the following domestic water piping specialties:

1. Balancing valves.
2. Strainers.
3. Outlet boxes.
4. Hose stations.
5. Hose bibs.
6. Drain valves.
7. Water hammer arresters.
8. Air vents.
9. Flexible connectors
10. Flow Sensing Devices
11. Puddle flanges

## 1.03 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa), unless otherwise indicated.

## 1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

## PART 2 - PRODUCTS

## 2.01 BALANCING VALVES

- A. Refer Section 15140

## 2.02 STRAINERS FOR DOMESTIC WATER PIPING

### A. Y-Pattern Strainers :

1. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
  - a. Strainers NPS 2 (DN 50) and Smaller: 0.020 inch (0.51 mm) .
  - b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 inch (1.14 mm)
6. Drain: Factory-installed, hose-end drain valve.

## 2.03 HOSE BIBBS

### A. Hose Bibbs :

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
8. Finish for Service Areas: Rough bronze, or chrome or nickel plated.
9. Finish for Finished Rooms: Chrome or nickel plated.
10. Operation for Equipment Rooms: Wheel handle or operating key.
11. Include operating key with each operating-key hose bibb.

## 2.04 DRAIN VALVES

### A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

### B. Gate-Valve-Type, Hose-End Drain Valves

1. Standard: MSS SP-80 for gate valves.

2. Pressure Rating: Class 125.
3. Size: NPS 3/4 (DN 20).
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 (DN 20) threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves :

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig (1380-kPa) minimum CWP or Class 125.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 (DN 6) side outlet with cap.

## 2.05 WATER HAMMER ARRESTERS

A. Water Hammer Arresters :

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Metal bellows / Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

## 2.06 AIR VENTS

A. Bolted-Construction Automatic Air Vents :

1. Body: Bronze.
2. Pressure Rating: 125-psig (860-kPa) minimum pressure rating at 140 deg F (60 deg C).
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 1/2 (DN 15) minimum inlet.
6. Air vents shall be installed on all coils and all other high points required for efficient operation and venting of system.
7. Air vents shall be provided at all high points in the pipework, whether indicated on the drawings or not.
8. Large diameter automatic air vents shall be provided at all primary venting positions, such as plant rooms and at the head of vertical risers.
9. Air bottles shall be provided at all venting points.
10. The Sub CONTRACTOR shall be responsible for the design and positioning of all air vents.

## 2.07 PUDDLE FLANGES

A. Where pipework passes through the external walls of the buildings or trenches below ground level, the CONTRACTOR shall supply and cast or built puddle flanges into the structure.

B. Puddle flanges are to be manufactured from the same material as the pipework of which they form a part.



- C. Each puddle flange shall comprise a length of pipe, flanged or screwed at end according to diameter with an undrilled slip on flange welded on the outside at a point where it will be located mid way in the thickness of the wall. The puddle flange is to be painted externally with two coats of bituminous paint before being built into the structure.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- B. Install balancing valves in locations where they can easily be adjusted.
- C. Install Y-pattern strainers for water on supply side of each pump.
- D. Install water hammer arresters in water piping according to PDI-WH 201.
- E. Install air vents at high points of water piping. [ Install drain piping and discharge onto floor drain.]

**END OF SECTION 15145**

**Sect.15150 - SANITARY WASTE, VENT AND STORM PIPING**

## PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

## 1.02 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
  - 1. Pipe, tube, and fittings.

## 1.03 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. LLDPE: Linear, low-density polyethylene plastic.
- D. NBR: Acrylonitrile-butadiene rubber.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. TPE: Thermoplastic elastomer.

## 1.04 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa) .
  - 2. Sanitary Sewer, Force-Main Piping: 150 psig (1035 kPa).
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events.

### 1.05 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings:
  - 1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
  - 2. Drainage System: Include plans, elevations, sections, and details.
- C. Field quality-control inspection and test reports.

### 1.06 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

## PART 2 - PRODUCTS

### 2.01 PIPING MATERIALS

- A. Piping materials shall be as under.

### 2.02 ABOVE GROUND SOIL, WASTE AND VENT PIPE

- A. All horizontal soil, waste pipes and rain water shall be Poly Propylene (PP) sound proof drainage pipes as per DIN 4109 and Din 4102 and fittings made of mineral-reinforced polypropylene homopolymer and copolymer. The typical density of the mineral filler shall be between 1.65 to 2.03 g/cm<sup>3</sup> according to DIN 53479.
- B. The sound isolation shall be 13 DB for 4.0 l/s flow rate in accordance with DIN 52379 and DIN 4109
- C. The sound proof pipes & fittings shall be fire resistant class B2 to DIN 4102.
- D. The sound proof pipes & fittings shall be fungus and bacteria resistant, and shall have smooth surface, corrosion resistant.
- E. Soundproof drainage pipe system shall comply with following standards:
  - 1. DIN 4109m sound proof, absorption standards.
  - 2. DIN 4102, B2. Self-extinguishing flameless.
  - 3. DIN 19560 / DIN EN 1451. Hot water resistance, 95°C (Long term), 95°C (short term).

## 4. Physical Characteristics

Density	1.65 g/cm <sup>3</sup> DIN 53479
Elongation at break	50%
Tensile strength E-modulus Linear expansion	20N / mm <sup>2</sup>
E-modulus	3800 N / mm <sup>2</sup>
Linear expansion	0.04 mm / mk

5. The floor trap shall also be of sound proof material to DIN 4109.

## 2.03 BELOW GROUND SOIL AND WASTE PIPE

- A. uPVC conforming to the following British Standards:
1. Pipes 110mm and 300mm diameter: uPVC pipe with solvent weld fitting as per BS 4660 (BS EN 1401)
  2. Pipes larger than 300mm diameter: to BS 3506.

## 2.04 STORM WATER PIPE

- A. Plastic pipes shall be extruded un-plasticized PVC (UPVC) conforming to the following British Standards:
1. uPVC pipe with solvent joints (as approved by consultant) as per DIN 8061/8062 and ISO 3633 Type B

## 2.05 CONTENSATE DRAIN PIPING (ABOVE AND BELOW GRADE)

- A. uPVC conforming to the following British Standards:
1. Pipes 20mm and 300mm diameter: Upvc class 'E' pipe with solvent weld fitting as per BS 3505 (EN 1401).

## 2.06 PRESSURE PIPING FROM PUMPS (ABOVE AND BELOW GRADE)

- A. uPVC conforming to the following British Standards:

1. Pipes 20mm and 300mm diameter: Upvc class 'E' pipe with solvent weld fitting as per BS 3505 (EN 1401).

B. Alternatively (Kite Mark) pipes are acceptable only if approved by consultant.

## 2.07 SPECIAL PIPE FITTINGS

## 2.08 ENCASEMENT FOR UNDERGROUND PIPING CROSSING DRIVEWAYS

- A. All Drainage pipes crossing driveways and subjected to heavy traffic shall be provided in concrete encasement.

## PART 3 - EXECUTION

### 3.01 EXCAVATION

- A. Refer to "Earthwork" for excavating, trenching, and backfilling.

### 3.02 PIPING INSTALLATION

- A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- B. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
- C. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- D. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
- E. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 2 DN 50 and smaller; 1 percent downward in direction of flow for piping NPS 3 (DN 75) and larger.
  2. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow.
  3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- F. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- G. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- H. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction or Consultant.

### 3.03 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 15 Section "Hangers and Supports." Install the following:
- B. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
  2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
  3. NPS 4 and 5 (DN 100 and 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
  4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
  5. NPS 8 to NPS 12 (DN 200 to DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
- C. Install supports for vertical PVC piping every 48 inches (1200 mm).

### 3.04 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  4. Equipment: Connect drainage piping as indicated.

### 3.05 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
  - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 6. Prepare reports for tests and required corrective action.

### 3.06 PROTECTION

- A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

**END OF SECTION 15150**



**Sect.15155 - DRAINAGE PIPING SPECIALTIES**

## PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

## 1.02 SUMMARY

- A. This Section includes the following drainage piping specialties:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Trench drains.
  - 4. Channel drainage systems.
  - 5. Roof drains.
  - 6. Manhole Covers
  - 7. Miscellaneous drainage piping specialties.

## 1.03 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PUR: Polyurethane plastic.
- H. PVC: Polyvinyl chloride plastic.

## 1.04 SUBMITTALS

- A. Product Data: For each type of product indicated above.
- B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

## 1.05 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

## 1.06 COORDINATION

- A. Coordinate size and location of concrete bases.
- B. Coordinate size and location of roof penetrations.

## PART 2 - PRODUCTS

## 2.01 CLEANOUTS

- A. Plastic Floor Cleanouts:
  - 1. Size: Same as connected branch.
  - 2. Body: PVC.
  - 3. Closure Plug: PVC.
  - 4. Riser: Drainage pipe fitting and riser to clean out of same material as drainage piping.
  - 5. Finish: Stainless steel cap

## 2.02 FLOOR DRAINS

- A. Plastic Floor Drains:
  - 1. Material: PP Soundproof as per piping material
  - 2. Outlet: Side
  - 3. Sediment Bucket: Not required.
  - 4. Top or Strainer Material: Stainless steel <Refer Architect finishes schedule>.
  - 5. Top of Body and Strainer Finish: Stainless steel.
  - 6. Top Shape: Square. <Refer Architect finishes schedule>.
  - 7. Trap Material: Plastic drainage piping.
  - 8. Trap Pattern: Standard Multi Floor Trap with Multiple inlets and one outlet.
- B. Funnel floor drain where specified on drawings shall include a nickel bronze funnel secured to the grating

## 2.03 TRENCH DRAINS

- A. Trench Drains :
  - 1. Standard: ASME A112.6.3 for trench drains.
  - 2. Outlet: Side.
  - 3. Grate Material: Cast Iron/PVC. <Refer Architect finishes schedule>.
  - 4. Grate Finish: Epoxy coated for cast iron <Refer Architect finishes schedule>.
  - 5. Dimensions of Frame and Grate: Refer drawings
  - 6. Top Loading Classification: As mentioned on MEP drawings and BOQ.

## 2.04 ROOF DRAINS

## A. Plastic Roof Drains:

1. Standard: ASME A112.21.2M.
2. Pattern: Balcony/ Roof drain.
3. Body Material: PVC.
4. Dimensions of Body: Refer Drawings
5. Outlet: Bottom.
6. Dome Material: PVC/Stainless Steel <<Refer Architect finishes schedule>.

## 2.05 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

## A. Vent Caps:

1. Description: PVC of same brand as of piping.
2. Size: Same as connected stack vent or vent stack.

## B. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

## C. Manholes/gully traps covers

1. All covers shall be Cast Iron with black bitumen coating. Manhole covers shall have clear opening of 600 x 600 mm.
2. All manholes and gully traps shall be vented as per drainage department requirements.
3. Gully trap covers shall have clear opening of 300 x 300 mm.
4. All manhole covers and frames shall comply with BS 497:1976 (BS EN 124:1994)
5. Covers in paved areas shall be medium duty type having weight as per Table 1
6. Covers in plinth protection shall be light duty having weight as per Table-1
7. Covers in Driveways shall be Heavy duty having weight as per Table-1

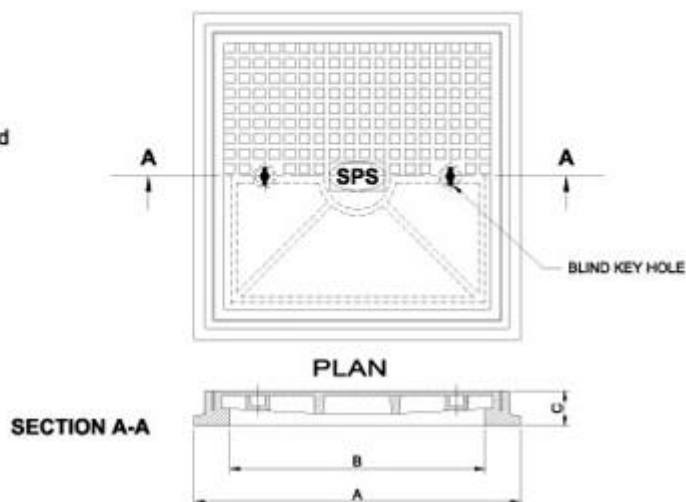
## CAST IRON MULTI DUTY MANHOLE COVER & FRAME

**Features :**

- Single Seal
- Closed Key Holes
- Coating Cold Applied

**Option :**

- Ductile Iron
- Epoxy Coated
- Lockable



**Table 1-1 (Manhole Covers Weights)**

S.no	Cover material	Clean Opening	Type	Weight	Standard	Remarks
1	Cast Iron	600 x 600	Light duty	45 Kg	BS EN 124:1994	
2	Cast Iron	600 x 600	Medium duty	67 Kg	BS EN 124:1994	
3	Cast Iron	600 x 600	Heavy duty	90 Kg	BS EN 124:1994	

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
  4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
1. Position floor drains for easy access and maintenance.
  2. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- E. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.
- F. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to ASME A112.3.1. Install on support devices so that top will be flush with surface.
- G. Install fixture air-admittance valves on fixture drain piping.
- H. Install stack air-admittance valves at top of stack vent and vent stack piping.
- I. Install air-admittance-valve wall boxes recessed in wall.
- J. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- K. Install through-penetration firestop assemblies in plastic stacks at floor penetrations.
- L. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  2. Size: Same as floor drain inlet.
- M. Install vent caps on each vent pipe passing through roof.
- N. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain **1-inch (25-mm)** clearance between vent pipe and roof substrate.
- O. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- P. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
  2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
  3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
  4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
- Q. Install grease removal devices on floor. Install trap, vent, and flow-control fitting according to authorities having jurisdiction. Install control panel adjacent to unit, unless otherwise indicated.
- R. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
- S. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.
- T. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

### 3.02 CONNECTIONS

- A. Install piping adjacent to equipment to allow service and maintenance.
- B. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.
- C. Oil Interceptors: Connect inlet, outlet, vent, and gravity drawoff piping to unit; flow-control fitting and vent to unit inlet piping; and gravity drawoff and suction piping to oil storage tank.

### 3.03 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
1. Grease interceptors.
  2. Oil interceptors.
  3. Solids interceptors.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

### 3.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled FOG disposal systems and grease

removal devices and their installation, including piping and electrical connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.05 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain FOG disposal systems and grease removal devices.

**END OF SECTION 15155**

**Sect.15410 - PLUMBING FIXTURES**

## 1.01 QUALITY ASSURANCE

- A. Quality Standard: NSF 61 for fixture materials in contact with potable water.

## 1.02 WARRANTY

- A. Materials and Workmanship:
1. Commercial Applications: One year.

## 1.03 FAUCETS

- A. Lavatory Faucets, <Refer Architecture fixture selection and Specifications>:
1. Two-handle mixing non-pressure type valve.
    - a. Body Material: Commercial, solid brass (with non-metallic coatings or Chrome finish as required by the architect).
    - b. Finish: Polished chrome plate.
    - c. Maximum Flow Rate: Maximum [2.5 gpm (9.46 L/min.)],
    - d. Mounting: [Deck, exposed] [Deck, concealed] [Back/wall, exposed] [Back/wall, concealed].
    - e. Spout: [Rigid, gooseneck] type.
    - f. Spout Outlet: Aerator/ Spray
- B. Sink Faucets, <Refer Architecture fixture selection and Specifications>:
1. [Kitchen faucet with spray, three-hole fixture].
    - a. Body Material: [Commercial, solid brass] (with non-metallic coatings or Chrome finish as required by the architect).
    - b. Finish: Polished chrome plate]
    - c. Maximum Flow Rate: 2.5 gpm (9.46 L/min.), unless otherwise indicated.
    - d. Mixing Valve: Two-lever handle.
    - e. Backflow Protection Device for Hose Outlet: Not required.
    - f. Mounting: Deck, Back/wall as recommended by the architect.
    - g. Spout Outlet: Aerator/ Spray
    - h. Drain: Stopper with chain.

## 1.04 TOILET SEATS

- A. Toilet Seats :
1. Toilet seat for water-closet-type fixture.



- a. Material: Molded, solid plastic.
- b. Configuration: front with cover.
- c. Size: Regular.
- d. Class: Standard commercial.

#### 1.05 FIXTURE SUPPORTS

##### A. Water-Closet Supports :

1. Combination carrier designed for standard mounting height of wall-mounting, water-closet-type fixture.

##### B. Lavatory Supports:

1. Type [lavatory carrier with exposed arms and tie rods] or [lavatory carrier with concealed arms and tie rod] for wall-mounting, lavatory-type fixture.

##### C. Sink Supports:

1. Type [sink carrier with exposed arms and tie rods] or [II, sink carrier with hanger plate, bearing studs, and tie rod] for sink-type fixture.

#### 1.06 WATER CLOSETS (WESTREN)

##### A. Water Closets, <Refer Architecture fixture selection and Specifications> :

1. Floor-mounting, floor-outlet, vitreous-china fixture designed for [gravity-type tank] operation.
  - a. Style: [Close coupled] [One piece].
    - 1) Bowl Type: Round front design. Include bolt caps matching fixture.
    - 2) Height: Standard.
    - 3) Design Consumption: Dual Flush Design with Major (6.0 L/flush) Minor (4 L/flush)].
    - 4) Tank: Gravity type. Include cover.
  - b. Supply: [NPS 3/8 (DN 10)] [NPS 1/2 (DN 15)] chrome-plated brass or copper with wheel-handle stop.
  - c. Toilet Seat: Included

#### 1.07 WATER CLOSETS (EASTREN)

##### A. Squatting WC, <Refer Architecture fixture selection and Specifications> :

1. Flat Bowl, vitreous-china fixture designed for [gravity-type tank] operation.
  - 1) Type: Flat and Shallow design
  - 2) Flush Tank : Yes (check drawings for installation height)

- 3) Design Consumption: Single Flush Design with Major (6.0 L/flush).
  - 4) Tank: Gravity type.
  - 5) Color (Refer Architecture fixture selection and Specifications)
- b. Supply: [NPS 1/2 (DN 15)] chrome-plated brass or copper with wheel-handle stop.
- c. DN50 supply pipe from Flush tank to WC. Pipe shall be concealed.

**END OF SECTION**

**Sect.15441 – PLUMBING PUMPS**

## PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

## 1.02 SUBMITTALS

- A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For domestic water pumps to include in emergency, operation, and maintenance manuals.

## 1.03 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of domestic water pumps and are based on the specific system indicated.
- B. 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.
- C. UL Compliance: Comply with UL 778 for motor-operated water pumps.

## 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

## 1.05 COORDINATION

- A. Coordinate size and location of concrete bases.

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**PART 2 - PRODUCTS****2.01 BOOSTER AND TRANSFER PUMPS****A. Manufacturers:**

1. Armstrong Pumps Inc.
2. Grundfos Pumps Corp.
3. Wilo Pumps
4. Refer Approved list of manufacturers

**B. Description: Factory-assembled and -tested, Multistage stage**

1. Supply and install transfer and Booster water Set designed for a total system capacity as shown on Pump Schedule. The systems shall be tested and calibrated, and shipped to the job site as an integral unit ready to receive suction and discharge piping and incoming power supply.
2. The unit shall be a packaged factory assembled and tested unit complete with duty/stand by pump, interconnecting pipework in copper, bronze, valves, safety devices and prewired control panel.
3. Pumps shall be constant speed:
4. Pump shall be bronze fitted centrifugal, single stage, end suction type
5. Pump shall be rated for a minimum of 175 PSIG working pressure.
6. Casings shall be cast iron with gauge ports, vent and drain ports at top and bottom of casing.
7. Shaft impeller shall be stainless steel 316.
8. The pumps shall be complete with temperature control, gate valves, check valves, pressure gauges, thermal bleed circuits, wiring, conduit and interconnecting pipe work, mounted on anti-vibration mountings and neatly arranged and firmly supported by the framework of the unit. Suction connection shall be horizontal, as close to the base as possible to connect to inlet pipe from the water storage tank.
9. Mechanical seals shall be with carbon rotating ring, stainless steel spring, ceramic seat and flexible bellows and gaskets. Grease lubricated ball type bearings shall be provided.
10. Pump and Motor Assembly: Hermetically sealed, replaceable type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.

C. Capacities and Characteristics:

1. Capacity: Refer Equipment Schedule
2. Total Dynamic Head: Refer Equipment Schedule
3. Maximum Continuous Operating Temperature: 220 deg F (104 deg C).
4. Impeller Size: As per Manufacturer Recommendation
5. Inlet and Outlet Size: As per Manufacturer Recommendation
6. Speed: As per Manufacturer Recommendation
7. Motor Horsepower: Refer Schedule
8. Brand used for design selection : Grundfos

2.02 CONTROLS

1. The pump set control panel shall be in a NEMA I enclosure which includes motor starters, time delays, protected control circuit, transformer, current relays, hand-off-automatic switches for each pump, minimum run timers, and low suction pressure cut out etc.
2. Transfer pump shall be controlled by float switch.

2.03 SUMP PUMPS

1. Pump casing shall be Stainless steel.
2. Impeller shall be stainless steel wear resistant, semi shrouded, multi vane with adjustable diffusers. Minimum particle size shall be 20mm
3. Shaft shall be Stainless Steel 316SS.
4. Motor shall be squirrel cage induction type, class F insulation capable of a maximum of 15 starts/hour.
5. Motor casings shall be with integral cooling ribs for maximum heat dissipation.
6. Pumps shall be fitted with two mechanical seals with silicon carbide rotating & seat stainless steel spring, flexible bellows and gaskets. The chamber between the shaft seal to be oil filled.
7. Shaft shall be mounted on pregreased rolling element bearings.
8. Cable junction chamber shall be a sealed terminal chamber with separate gland assemblies incorporating strain relief clamps.
9. Pumps shall be suitable for a maximum depth of submersion with the flanged outlet directed vertical upwards.
10. Pumps shall be selected to match the duties indicated on drawings.

11. Pumps shall be supplied with control panel complete with integrated fuse elements, handoff automatic switch, motor contactor, duty pump selector switch, run/trip lamps for individual pumps etc. Pumps shall be controlled by a unit mounted float control. The pumps shall operate at high level and stop at low level of water in the sump pit.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

### 3.02 CONCRETE BASES

- A. Install concrete bases of dimensions indicated for pumps and controllers.
  1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
  2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  4. Install anchor bolts to elevations required for proper attachment to supported equipment.

### 3.03 PUMP INSTALLATION

- A. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

### 3.04 CONNECTIONS

- A. Install piping adjacent to pumps to allow service and maintenance.
- B. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
  1. Install flexible connectors adjacent to pumps in suction and discharge piping of pumps:

2. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps
3. Install pressure gages at suction and discharge of pumps.

### 3.05 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  1. Complete installation and startup checks according to manufacturer's written instructions.
  2. Check piping connections for tightness.
  3. Clean strainers on suction piping.
  4. Perform the following startup checks for each pump before starting:
    - a. Verify bearing lubrication.
    - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    - c. Verify that pump is rotating in the correct direction.
  5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
  6. Start motor.
  7. Open discharge valve slowly.
  8. Adjust timer settings.

### 3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

**END OF SECTION 15441**

# **Technical Specifications**

## **Fire Fighting**



## **FIRE FIGHTING PIPING AND SPECIALTIES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions, including General and Supplementary Conditions and relevant sections Specifications, apply to this Section.
- B. The work Includes supply, installation, testing and commissioning of Wet Riser as an integral part of the complete Fire Services Installation including 24/7 Remote Monitoring system complete as per standards and requirement of Local Civil Defense Authority.
- C. All works shall be carried out as shown on drawings in full compliance with NFPA standards, authorities having jurisdiction (AHJ), Local Civil Defense Authority and requirements associated with UL and FM.
- D. The fire protection contractor shall be experienced in the design and installation of fire protection systems as per NFPA standards and shall be approved by PEC and Local Civil Defense.

#### **1.2 SUBMISSIONS**

- A. Submit the complete fire protection system data sheets. List piping material types, ASTM number, schedule or pressure class, manufacturer and model number where appropriate. List valves, specialties and equipment with manufacturer and model number.
- B. Shop drawings shall indicate water supply location and size, piping layout and size, hanger locations and type, equipment locations and type, valve locations and type, occupancy classes, hydraulic calculations reference points, node references of remote area and discharge densities. Fire suppression data, classification, and fire and smoke partitions shall also be indicated.
- C. Submit hydraulic calculations for water supply. Include summary sheet and detailed work sheets. Describe characteristics of water supply and location of effective point used in calculations. Include graph illustration of water supply, hose demand, sprinkler demand
- D. Together with Shop Drawings and Product Data, Plans and Specifications shall be submitted in conformance with NFPA. Contractor shall be responsible for obtaining approvals from Local Civil Defence Authority.

- E. Test Reports shall be submitted in accordance with the approved format giving all required test details.
- F. Steel pipes: Statement from manufacturer on his letterhead that the pipe furnished meets the BS and/or ASTM specification contained in this section. Contractor shall submit the Mill certification papers, also known as material test reports, for the pipe furnished for this project, in English. Heat numbers on these papers to match the heat numbers stenciled on the pipe. Chemical analysis indicated on the mill certification papers to meet or exceed the requirements of the referenced BS and/or ASTM specification.

### **1.3 QUALITY ASSURANCE AND CONTROL**

- A. Materials construction and installation methods of all piping, fittings and valves shall conform to the current acceptable standards of Authorities having jurisdictions (AHJ) and NFPA. All components used shall be UL listed and FM approved unless stated.
- B. Contractor shall use all Steel pipes with heat numbers rolled, stamped, or stenciled to each length or each bundle, depending on the size of the pipe, and in accordance with the appropriate specifications.
- C. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications.
- D. All equipment and components used for firefighting installation shall be approved by the local authority and fully compliant with its requirements.
- E. Contractor has to comply with any new or additional requirement for Civil Defense on his own expense.

### **1.4 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Handle equipment and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged pumps or components, replace with new.
- B. Store equipment and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

### **1.5 SUMMARY**

- A. Fire-suppression piping inside the building:
  - 1. Automatic wet-type, Class III standpipe systems.

## 1.6 SCOPE OF WORKS

The work Includes supply, installation, testing and commissioning of Wet Riser as an integral part of the complete Fire Services Installation including 24/7 Remote Monitoring system complete as per standards and requirement of Local Civil Defense Authority.

The work shall also include not only the major items of the system and equipment but also all the incidental sundry components necessary together with the resources for installing such components, for the complete execution of the systems and for trouble free operations, whether or not these sundry components are stated in detail in this contract document.

All works shall be carried out as shown on drawings in full compliance with NFPA standards and Local Civil Defense Authority.

Contractor to install, test and execute the entire fire system as per Design drawings and NFPA Requirements. The following shall be included in the scope of contractor but shall not be limited to it.

- Preparation for installation of piping, valves and fire equipment
- Installation, testing and Commissioning of Fire specialties
- Installation of Fire Extinguishers as indicated on the drawings and as directed by engineer in charge.
- Installation, testing and Commissioning of Pre Engineered Clean Agent fire suppression system as per NFPA-2001
- Installation of UL/FM Supports for fire piping and Specialties.
- Installation of fire protection systems in accordance with NFPA rulings, listings and manufacturers recommendations.
- Where piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

### A. Preparation

Ream all pipe to full inside diameter after cutting and thoroughly clean before erection. All material shall have proper identification marks that can be verified prior to installation.

### B. Installation

Install fire protection systems in accordance with NFPA rulings, listings and manufacturers recommendations. Locate where accessible for servicing and replacement.

**C. Painting**

All exposed firefighting pipe work (whether exposed or concealed) shall be given one coat of approved primer (should be an etch type primer suitable for galvanized pipes) and two coats of approved post office enamel paint to ID/Civil defense requirements. Identification and marking shall be in accordance with Mechanical Identification and shall fully comply with NFPA regulations.

**D. Pre Commissioning Cleaning**

Before installations are handed over or subjected to inspection and testing, the entire installation shall be thoroughly cleaned, both internally and externally.

All fire protection installation shall be flushed out with clean water. During the flushing out, provision/special care shall be made for water discharge and subcontractor should ensure that the cleaning operation avoids any damage to the plant and other services installed. The entire operation shall be carried out to the satisfaction of the Engineer. The contractor shall submit the method statement for review prior to commencement of any works related with commissioning.

**E. Testing and Commissioning**

Testing and Commissioning shall be as per NFPA-25

The fire protection piping system shall be tested hydrostatically for not less than 6 hours at 1 ½ times the system pressure without leak.

Testing of pipe networks in sections or entire system shall be carried out as required by sequence of construction program. Do not conceal any pipework unless and until it has been successfully tested and certified. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. The entire test must be witnessed and certified by the CONSULTANT. All pressure test reports are to be documented in accordance with NFPA Contractor's Material and Test Certificate forms.

Use clean water and remove air from the piping being tested where possible. Measure and record test pressure at the high point in the system.

**1.7 SYSTEM PERFORMANCE REQUIREMENTS**

- A. Standard Piping System Component Working Pressure: Listed for at least 300 PSI.

**1.8 SAMPLES**

Contractor shall prove at his cost, samples of material, instruments, gauges and electrical items, for approval by the Engineer before order is placed for the same.

Engineer may waive this requirement, if detailed published catalogues submitted by the Contractor provide sufficient information for approval. These samples shall include, but not limited to:

- A. Seamless black steel Pipes and Fittings.
- B. Fire Hose Cabinet and Reel
- C. Fire Specialties
- D. Pressure Gauges, Air Vents
- E. Power and control cables.
- F. Electrical items push buttons, HOA & toggle switches, pilot lamp, contractor, relays, circuit breakers and isolating switches.
- G. Vibration isolating springs, pipe supports and hangers.

#### **1.9 QUALITY ASSURANCE**

- A. Quality Standard: [NFPA 13] [NFPA 14] [NFPA 20] [NFPA 24][other NFPA Standards].

### **PART 2 - PRODUCTS**

#### **2.1 STEEL PIPE AND FITTINGS (Above ground installation)**

- A. The Above ground piping shall be Seamless Black Steel Pipe: as per ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 Schedule 40 with heavy duty welded fittings.
- B. Fittings for piping 50mm and below shall be UL/FM threaded malleable iron Class 250 to ANSI B16.4

- C. Fittings for piping greater than 50mm shall be extra heavy galvanized fittings class 300 to ANSI B16.9

## 2.2 STEEL PIPE AND FITTINGS (Buried Piping)

- A. The Above ground piping shall be Seamless Black Steel Pipe: as per ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 Schedule 40 with heavy duty welded fittings.
- B. All External Water Supply pipes shall be high density polyethylene pipes (HDPE) and shall comply with the requirements of DIN 8074/8075 or ISO 4427 type PE 100 SDR 11 -(standard dimension ratio) PN-16 and tests are made in accordance with American Standards ASTM D1248/D3035/F714 or Equivalent ISO Standards.
- C. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.
- D. The pipes shall be suitable for underground installation for drinking water at a working pressure up to 12 bar at 20°C or 9 bars at 35°C.
- E. The pipe nominal size and wall thickness shall be to the following dimensions.

Mean Outside Diameter OD (mm)	Minimum Wall Thickness (mm) SD R11, PN-16	Internal Diameter ID (mm) SD R11, PN-16
50	4.6	40.8
75	6.8	61.4
90	8.2	73.6
110	10	90
125	11.4	102.2
160	14.6	130.8
200	18.2	163.6
225	20.5	184
250	22.7	204.6
315	28.6	257.8
355	32.2	290.6

400	36.3	327.4
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The minimum required strength (MRS) of the polyethylene pipe shall be 8 MPa at 20°C and 50 years life time. The design stress shall be 6.3 MPa.

The polyethylene pipe shall meet the following specification:

Property	Test Method	Units	PE 100
Density (Compound)	ISO 1183	Kg/m <sup>3</sup>	959
Melt Flow Rate(190°C/5kg)	ISO 1133	g/10 min	0.25
Tensile Stress at Yield(50mm/min)	ISO 527-2	MPa	25
Elongation at Break	ISO 527-2	%	> 600
Charpy Impact Strength, notched	ISO 179/1eA	kJ/m <sup>2</sup>	16
Vicat Softening Point	ASTM D 1525	°C	122
Brittleness Temperature	ASTM D 746	°C	< -70
ESCR (10% Igepal), F50	ASTM D 1693A	Hrs.	>10,000
Thermal Conductivity	DIN 52612	W/m <sup>°K</sup>	0.4
Linear Thermal Expansion	ASTM D 696	K <sup>-1</sup>	1.5x10 <sup>-4</sup>

The pipes shall be manufactured from polyethylene containing only those antioxidants, UV stabilisers and pigments necessary for the manufacturing of the pipes.

Polyethylene pipes shall be black colour. The carbon black content in the compound shall be 2.25 + 0.25 % by mass when measured in accordance with ISO 6964. The dispersion of carbon black when determined in accordance with ISO 11420 shall be equal to or less than grade 3.

The thermal stability of polyethylene material shall meet the requirements of ISO 4427.

If rework material is added or used, it shall be clean, derived from the same resin and reground under the supervision of the same manufacturer and shall be compatible with the material to which it is added.

The material of the polyethylene pipe which is in contact with or likely to come in contact with drinking water shall not constitute a toxic hazard, shall not support microbial growth and shall not give rise to unpleasant test or odor, cloudiness or discoloration of the water.

The concentration of substances, chemical and biological agents leached from materials in contact with drinking water, and measurement of the relevant organoleptic / physical parameters, shall not exceed the maximum values recommended by the World Health Organization in its "Guidelines for Drinking Water Quality" or the EEC Council Directive on the "Quality of Water Intended for Human Consumption", whichever is more stringent in each case.

Polyethylene pipes shall be clearly marked at intervals of one meter indicating the manufacturer name, nominal diameter, standard number, pipe class, pressure rating and date of pipe manufacturing. The word "WATER" shall also be marked every one meter. The marking shall be by means of paint or engraved marks. All markings shall be in blue color.

The pipes shall kept shaded at all times. The coils shall be wrapped and shall not be exposed to direct sunlight.

## 2.2 FIRE PIPE SUPPORT

- A. All pipe supports shall be as per NFPA 13 and shall be listed.
- B. Contractor to Submit Fire Support calculations indicating the desired pipe load with water as per NFPA-13
  1. Horizontal installation:
    - a) For Pipe size upto 2"Ø = Use UL Listed/ FM Approved adjustable swivel ring.
    - b) For Pipe size above 2" Ø = Use UL Listed/ FM Approved clevis hanger

Maximum Spacing between Single Pipe Supports for steel pipes:

Nominal Pipe Size, mm												
15	20	25	32	40	50	65	80	100	125	150	200	250
Maximum Span Meters												
1.5	1.8	2.1	2.1	2.7	3.0	3.4	3.7	4.3	4.9	5.1	5.8	6.1
Minimum Rod Diameter, Millimeters												
6.4	6.4	9.5	9.5	9.5	9.5	13	13	16	16	16	19	24

- C. The hanger rods shall be capable of supporting at least twice the Live load of the system. The Minimum rod diameters for various pipe diameters shall be as per NFPA-13



- D. Clevis hanger shall be adjustable of yoke and lower U strap with cross bolts. Cross bolts shall have a double locking nut. Vertical support rod shall have a load nut below the yoke. Vertical inserts installed using power activated gun shall not be acceptable. 'C' type beam clamps shall not be acceptable
- E. Concrete inserts shall be FM galvanized malleable iron poured in place type, screwed of toggle style
- F. Concrete anchors shall be FM Cadmium plated malleable iron or alloy steel expansion shield type.
- G. Welded steel brackets for supporting loads up to 390 kd shall be galvanized steel and designed to accept standard hanger rod and pipe supporting devises.
- H. Riser clamps shall be galvanized steel bands shaped to tightly fit O.D of pipe, secure with bolts.
- I. Provided Seismic Support as per NFPA-13 for pipe size 50mm and greater. Contractor to submit the Seismic design report from manufacturer.

### **2.3 LISTED FIRE-PROTECTION VALVES**

- A. Valves shall be UL listed or FM approved, with 300 psig minimum pressure rating.
- B. O.S & Y Gate Valves:
  - 1. 50mm and smaller: Outside screw and yoke gate valves, bronze body, bronze mounted, screwed bonnet, rising stem, solid wedge, with normally open supervisory/tamper switch with double wire leads.
  - 2. 65mm and larger: UL 262 Outside screw and yoke gate valves, cast iron body, bronze mounted, bolted bonnet, rising stem, solid wedge, with normally open supervisory/tamper switch with double wire leads and rising stem.
- C. Butterfly Valves: UL 1091.
  - 1. 50mm and smaller: Bronze body butterfly valve, geared operator, visible position indicator, normally open supervisory/tamper switch with double wire leads, stainless steel disc and stem.
  - 2. 50mm and larger: Cast or ductile iron body butterfly valve, lug style, geared operator, visible position indicator, normally open supervisory/tamper switch with double wire leads, EPDM resilient seat, EPDM seals, nickel plated ductile iron disc. Valve assembly to be bubble tight to at least 1.5 times working pressure with no downstream flange/pipe attached. Use cap screws for removal of downstream piping while using the valve for system shutoff.
- D. Supervisory/tamper switches:

1. For O S & Y valve or butterfly valve installations, local authority/approved, to monitor position of valve, tamper resistant cover screws, single or double SPDT switch contacts, corrosion resistant, for indoor or outdoor use, NEMA 4 & 6P enclosures.

E. Check Valves

1. 50mm and smaller: UL listed Bronze body, threaded end, Y pattern, regrindable bronze seat, renewable bronze disc, suitable for installation in a horizontal or vertical line with flow upward.
2. 65mm and larger: UL 312 Cast or ductile iron body, flanged ends, bronze trim, bolted cap, renewable bronze seat and disc, suitable for installation in a horizontal or vertical line with flow upward.

## 2.4 LANDING VALVES

- A. Hydrant outlets should be of a type acceptable to the public fire brigade and should comprise a valve 65mm bore constructed in gun metal, screwed or flanged for attachment to the riser and fitted with a 65 mm instantaneous female coupling and a blank cap secured by a suitable length of chain.
- B. The valve gate should lift clear of the waterway and the valve cover should be securely fitted to the valve body so that it does not unscrew when operated.
- C. The valve spindle should not be less than 22mm diameter and fitted with a gun metal hand wheel about 150mm in diameter which should be anticlockwise.
- D. The whole fitting should be of sound construction and shall be suitable for a working pressure of 27 bar. Valve shall comply with BS 5041.
- E. The hydrant outlet valves used shall be of the type incorporating a device to limit the outlet pressure to a maximum of 6.9 bar. The instantaneous coupling shall be of the single lug twist release instantaneous pattern with vulcanized rubber blank cap. Authority approved

## 2.5 FLEXIBLE FIRE HOSES AND NOZZLE

- A. Hoses shall be 65mm diameter suitable for a maximum working pressure of 17 kg/cm<sup>2</sup>. Hoses shall be all synthetic nylon wrap and weft totally encapsulated in PVC/N to form a unified lining and cover. Hoses shall be authority approved or certified by an equal certification authority for use on fire service. Hose length shall be 30M and shall terminate in a nozzle at one end. Nozzle shall be light weight of aluminum alloy with three operating positions OFF, STRAIGHT JET and WATER SUPPLY.

- B. The other end of the flexible hose shall have a quick connect coupling to suit the landing valve.

## 2.6 FIRE HOSE CABINET

- A. Fire hose cabinets, valves, hose and accessories shall be approved by and shall be in conformance with the requirements of the Authorities
- B. Fire cabinets shall be Full stainless steel with brush / Mirror finish. Hinges shall be solid, pin type machined from steel rods and welded to cabinet and door.
- C. Door edges shall be boxed and shall have recessed handle in stainless steel.
- D. The dimensions and details shall be (H=1600 W=800 D=300) as per drawings. In case required by the consultant and client cabinets shall be given two (2) coats of red oxide primer and finished with two (2) coats of fire red enamel but this shall only be subject to consultants approval.

### Design Features

- E. Upper compartment specially designed for mounting swinging pipe type hose reels (size - 1" x 30 mtr long).
- F. Lower compartment can accommodate the following: 2.5" x 30 mtr. lay flat fire hose + 2 portable extinguishers + 2.5" landing valve + nozzle as detailed in the drawings.
- G. Special hose reel mounting bracket with minimal cabinet depth.
- H. Swinging pipe type hose reel can be mounted on either side of the cabinet based on the site condition/ riser access.
- I. Inlet lock shield control valve, pressure reducing valve are fixed.
- J. Cabinet can be with Door Made of Full Stainless Steel sheet Brush Finish.
- K. Cabinet painted with Red (RAL 3000) electrostatic powder coating. (only if requested by the client)
- L. Fire hose cabinets and Fire Extinguisher cabinets shall be vertical combined hose reel cabinet and fire extinguisher compartment as shown on drawings.
- M. Cabinets shall be suitable either for recessed or surface installation in locations as indicated on drawings.
- N. Painted on the door of the fire hose cabinet with minimum 7mm block letters shall be the following notice in English and Urdu.

**IMPORTANT****PULL HOSE FROM REEL****WATER WILL FLOW AUTOMATICALLY**

- O. Hose reel cabinet shall contain a chrome plated swing hose reel complete with 30m of 25mm double red braided rubber firehose to BSEN 6711 with chrome plated brass shutoff nozzle clamped ends, automatic valve to open water flow after 2 ½ turns of the reel and 25 mm key operated shutoff valve. All metal parts shall be polished and chrome plated.

**2.7 PORTABLE FIRE EXTINGUISHERS**

- A. Fire extinguishers shall be to the approval of the local authorities.
- B. Fire extinguishers shall be provided in each Mechanical, telephone and Electrical Rooms and shall be, approved by the local authorities.
- C. Water fire extinguisher shall be provided wherever indicated on the drawings, these shall be of 9 liter capacity water filled made of stainless steel material approved by the Local Authorities.
- D. Extinguishers for use in Mechanical, Electrical and telephone Rooms shall be furnished with wall bracket and shall be mounted on walls.
- E. The pressure test on the extinguishers shall remain valid for 5 years.
- F. Mount all fire extinguishers in offices and public areas in Fire Extinguisher Cabinets similar to the cabinets described for those reels with die cut lettering label 'Fire Extinguisher'.

**2.8 FLEXIBLE FIRE HOSES AND NOZZLE**

- A. Hoses shall be 65mm diameter suitable for a maximum working pressure of 17 Kg/cm<sup>2</sup>. Hoses shall be all synthetic nylon wrap and weft totally encapsulated in PVC/N to form a unified lining and cover. Hoses shall be authority approved. Hose length shall be 30M and shall terminate in a nozzle at one end. Nozzle shall be light weight of aluminum alloy with three operating positions OFF, STRAIGHT JET and WATER SPRAY.
- B. The other end of the flexible hose shall have a quick connect coupling to suit the fire hydrant.

## 2.9 DRAINAGE OF FIRE PROTECTION NETWORK.

Fire suppression system piping shall be installed such that all system piping can be drained.

Drainage to the system alarm valve is preferred although it is recognized this may not be achieved in all circumstances.

System supply risers shall be provided with drain connections sized at a minimum of 20mm (3/4") for pipes up to 50mm (2"), 32mm (1.25") for pipes 65mm (2.5") to 100mm (4") and 50mm (2") for pipes 150mm (6") and larger. For isolated trapped sections in wet systems the auxiliary drain shall consist of a 25mm (1") or larger pipe into an easily accessible location preferably in the vicinity of a draining facility of the sewer system. For convenience drains other than the systems main drain shall always be provided with a hose coupling.

## 2.10 INSPECTORS TEST ARRANGEMENT

Each sprinkler system at each floor level shall be provided with an inspectors test arrangement. This arrangement shall be connected to the highest and end of the most remote branch pipe of each system, and piped to terminate with a suitable orifice equivalent to the smallest sprinkler diameter orifice, installed in the system. A test valve shall be located within the building at a height not exceeding 7 feet (2.13 metres) above floor level, and a site glass and orifice restriction shall be located at approximately 914mm (3 feet) above ground level.

## 2.11 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch-(250-mm-) diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 (DN 20) inlet and NPS 1 (DN 25) drain connections.
- C. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 300 psi pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
- D. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

**2.12 PRESSURE GAGES**

- A. Description: UL 393, 3-1/2- to 4-1/2-inch (90- to 115-mm-) diameter, dial pressure gage with range of 0 to 350 psig minimum
  - 1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.

**2.13 PRESSURE REDUCING VALVES**

- A. Where required for installation in the Fire Protection Systems, the PRV shall be UL/FM direct acting, site adjustable type, of bronze (up to 50mm) or cast iron (65mm and larger) construction
- B. The pressure reducing valves shall be suitable for maximum working pressure that exist within the system and downstream pressure should be site adjustable between 2 and 4 bar. Refer to Schematic drawings for the minimum locations at which PRV's shall be required. (All PRVs shall be equipped with built in pressure guage and Gate Valves on Both Sides / PRVs shall be installed as working & standby arrangement weather shown or not shown on drawings.

**PART 3 - EXECUTION****3.1 PIPING APPLICATIONS, GENERAL**

- A. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- B. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe.

**3.2 STANDPIPE SYSTEM PIPING APPLICATIONS**

- A. Standard-weight seamless galvanized steel pipewith electric Arc heavy duty fittings.

**3.3 VALVE APPLICATIONS**

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA
    - a. Shutoff Duty: Use butterfly or gate valves.

2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13
  - a. Shutoff Duty: Use butterfly or gate valves.
  - b. Throttling Duty: Use globe valves.

### **3.4 WATER-SUPPLY CONNECTION**

- A. Connect fire-suppression piping to building's interior water distribution piping. .
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water distribution piping.

### **3.5 PIPING INSTALLATION**

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
  1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- C. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger connections.
- D. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- E. Install sprinkler piping with drains for complete system drainage.
- F. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- G. Install drain valves on standpipes.
- H. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- I. Install alarm devices in piping systems.
- J. Hangers and Supports: Comply with NFPA 13 for hanger materials.
  1. Install standpipe system piping according to NFPA 14.

2. Install sprinkler system piping according to NFPA 13.
- K. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage. All Seismic supports shall be installed as per NFPA-13
- L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- M. Fill wet-standpipe system piping with water.
- N. Fill wet-pipe sprinkler system piping with water.
- O. Install flexible connectors on fire-pump and pressure-maintenance-pump supply and discharge connections.

### **3.6 VALVE INSTALLATION**

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.
- D. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.

### **3.7 HOSE-CONNECTION INSTALLATION**

- A. Install hose connections adjacent to standpipes, unless otherwise indicated.
- B. Install freestanding hose connections for access and minimum passage restriction.
- C. Install hose-connection valves with flow-restricting device, unless otherwise indicated.
- D. Install wall-mounting-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose.



**3.8 FIRE DEPARTMENT CONNECTION INSTALLATION**

- A. Install wall-type, fire department connections in vertical wall.
- B. Install ball drip valve at each check valve for fire department connection.

**3.9 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- D. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- E. Electrical Connections: Refer electrical specifications.
- F. Connect alarm devices to fire alarm.

**3.10 LABELING AND IDENTIFICATION**

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13

**3.11 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 3. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
  - 4. Coordinate with fire alarm tests. Operate as required.
  - 5. Verify that equipment hose threads are same as local fire department equipment.
- B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

# **Technical Specifications**

## **HVAC Works**

**TECHNICAL SPECIFICATIONS – AIR CONDITIONING & MECHANICAL VENTILATION WORKS**

1. GENERAL
2. DX SPLIT AIR CONDITIONING UNITS
3. HVAC FANS
4. DUCT WORKS
5. AIR DEVICES
6. ELECTRICAL WORKS
7. TESTING, BALANCING & COMMISSIONING
8. PAINTING AND FINISHING
9. OPERATING AND MAINTENANCE INSTRUCTIONS
10. TEST RUN
11. LIST OF APPROVED MANUFACTURERS

**TECHNICAL SPECIFICATIONS – AIR CONDITIONING & MECHANICAL VENTILATION WORKS****1.0 GENERAL:**

The contract drawings indicate the extent and general arrangement of the Air Conditioning and Mechanical Ventilation System. Equipments, ducting and piping shall fit into the space allotted and shall allow adequate and acceptable clearance for entry, servicing and maintenance. Where component parts of equipment or system cannot be serviced without distributing adjacent work resulting from original installation of other work, corrective action satisfactory to the Client / Project Managers / Consultant shall be taken, without any additional cost to the Owner.

- (a) Capacities of equipment and materials shall not be less than those indicated.
- (b) Conformance with Agency requirements: Where materials or equipment are specified to conform to requirements of Underwriter's laboratory, Inc., Air-conditioning and Refrigeration Institute of Heating, Refrigeration and Air-conditioning Engineers, etc., the Contractor shall submit proof of conformance. The label or listing of the specified agency will be acceptable evidence.
- (c) Nameplates: Each major item of equipment shall have the manufacturer's name, address serial and model numbers on a plate securely attached to the item.
- (d) Protective and Access requirements: Belts, pulleys, chains, gears, coupling, projecting set-screws, keys and other rotating parts are so located that any person in close proximity shall be fully enclosed or properly guarded. High temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type as specified by the manufacturer. Items such as catwalk ladders and quadrails shall be provided where indicated for safe operation and maintenance of equipment.
- (e) Verification of dimensions: The Contractor shall visit the premises to thoroughly familiarize himself with all details of the work and working conditions and verify all dimensions in the field, and shall advise the Client / Project Managers / Consultant of any discrepancy before performing any work. The Contractor shall be specifically responsible for the co-ordination and proper relation of his work to the building structure and to the work of all trades.
- (f) All opening / shafts and pipes and ducts, crossing walls and fire

rated wall, the gap between opening / shaft / wall and pipe / duct shall be fire sealed through approved fire stopping material of International Standards.

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

### **1.1 Equipment and Material:**

- (a) General:

These shall conform to the respective publications and other requirements specified herein, and as shown on the drawings and shall be the products of the manufacturers regularly engaged in the manufacture of such products. Items of equipment shall essentially be duplicate of equipment that has been in satisfactory use at least 10 years prior to bid opening and shall be supported by a service organization that is, in the opinion of the Client / Project Managers / Consultant, reasonably convenient to the site. It shall be solely the Contractor's responsibility to ensure that the equipment / material supplied by him shall fit into the space allotted for the purpose. If at any stage it is detected that the equipment supplied by him cannot fit into the space provided for the equipment, then the Contractor shall be responsible for supplying other equipment of suitable size, without incurring any additional cost to the Owner / Employer.

- (b) Approval of Equipment and Material:

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

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

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

## **1.2 Equipment and Material:**

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

- (a) Pipe Insulation and Covering
- (b) Adhesive, Tapes and Sealant
- (c) Electrical Items (Power, Control and Communication Cables, Conduit, Circuit Breakers)
- (d) Hangers and Supports
- (e) Copper Piping and Fittings
- (f) Condensate Drain Piping and Fittings
- (g) G.I Sheet, each gauge to be used
- (h) Air Devices (Diffusers, Grilles, Registers)
- (i) All Types of Dampers
- (j) Vibration Isolating Springs

## **2.0 DX SPLIT AIR CONDITIONING UNITS:**

### **2.1 General:**

Dx Split system air-conditioning Units, cool only type Units to be in two parts indoor & outdoor units, including filters, evaporator coils, compressors, condenser coils, and fan section, connection to electric power point, refrigerant piping, remote sensors, control wiring, complete in all respect. Minimum efficiency shall not be less than 18 SEER.

Provide units pre-piped, pre-wired, pre-charged refrigerant gas (Ozone Friendly Green Gas), factory assembled and factory tested, with all controls pretested prior to shipping. Provide a terminal strip with each electrical component individually and separately wired to strip. Provide a separate fuse, internally mounted, for each electrical component. A single fuse for multiple compressors or fan motors will not be accepted.

### **2.2 Indoor Unit:**

#### **2.2.1 Cabinet, Casing and Frame:**

Unit framework to be formed of structural steel members of 12 to 14 gauge mild steel. After assembly paint the framework for maximum protection against rust. Exterior panels to be fabricated of 18 gauge galvanized steel finished with a baked acrylic enamel over an epoxy primer. Provide neoprene gasket between panels and frame members; panels to be attached to the frame with quick release latches (no sheet metal screws). Insulate sections including compressor compartment with 1" thick, 3-lb/cu. ft density fiberglass having an R value of 4.16.

Arrange units for full front, side and rear service access to all mechanical, electrical and refrigeration controls, check out of electrical control panel, without disrupting or interfering with air flow.

#### **2.2.2 Supply Fan and Motor:**

Provide single width, forward curved Class I & II supply fans secured to a machined, ground and polished solid steel shaft. Coat shaft with a rust inhibitor and support by two outboard bearings selected for a minimum 200,000 hours average life.

Provide three-phase NEMA design 'B', 40qC continuously rated fan motor with energy-saving design, .85 power factor, NEMA 'T' frame, open drip-proof, operating at 1750 rpm and supplied with grease-lubricated ball bearings.

#### **2.2.3 Direct Expansion Coil:**

Provide direct expansion coil with ½" OD seamless copper tubes

Expanded into copper fins, not less than 3 rows deep or more than 12 fins

per inch. Provide evaporator coil with a distributor with side port for hot gas bypass and thermostatic expansion valve with adjustable superheat and external equalizer. Test coil at 300 PSIG air pressure under water, completely dehydrate and pressure test with refrigerant. Provide coils with heavy gauge, insulated, galvanized steel drain pans complete with mastic coating for corrosion protection.

#### 2.2.4 Filters:

Active carbon and catechin filters to be provided.

#### 2.2.5 Evaporator Defrost Thermostat:

Provide defrost thermostat package with enclosure, wiring and hardware for field installation.

### **2.3 Condensing Unit:**

#### 2.3.1 General:

Provide units pre-piped and pre-wired, pre-charged refrigerant gas, factory assembled and factory tested, with all controls pre-tested prior to shipping. Design units for use with Ozone Friendly Green Gas Refrigerant.

Assemble all condenser components on a common base in a weatherproof housing. Provide condenser coil, condenser fans and motors, refrigerant reservoir, charging valve, all controls and holding charge of Refrigerant.

#### 2.3.2 Condenser Coil:

Construct condenser coil of copper plate fins, mechanically bonded to seamless copper tubes. Circuit coil for sub-cooling. Test coils to 425 psi.

#### 2.3.3 Condenser Fans and Motors:

Furnish direct driven, propeller type belt driven, centrifugal fans arranged for vertical horizontal discharge. Provide condenser fan motors of the permanently lubricated type, resiliently mounted. Provide a safety guard for each fan. Include controls for cycling fans for intermediate season operation and low ambient control. Balance each fan statically and dynamically.

#### 2.3.4 Controls:

Locate factory wired controls in a separate enclosure. Provide high and Low pressure switches and compressor overload devices. Incorporate a positive acting timer to prevent short cycling of compressor if power is interrupted. Timer to prevent compressor from restarting for approximately



5 minutes after shutdown.

#### 2.3.5 Refrigerant Circuits:

Each refrigerant circuit is to be an independent circuit completely piped, tested, dehydrated and fully charged with oil and Ozone Friendly Green Gas Refrigerant. The Refrigerant circuits are to include compressor, condenser coil with integral liquid sub-cooler, liquid line service and charging valve, filter drier, and sight glass. Compressor units to include suction and discharge line braided-wire isolators.

#### 2.3.6 Casing:

Make unit casing fully weatherproof for outdoor installation. Construct casing of galvaneal steel, zinc phosphatized and finished with baked enamel. Provide openings for power and refrigerant connections. Make panels removable for servicing. Provide heavy duty coil guards, unit mounting rails and drain holes.

### 2.4 Execution:

Provide refrigerant piping and accessories to connect condensing unit's condensers to indoor air conditioning units according to manufacturer's instructions.

Copper pipes shall be insulated with 1-1/4" (32 mm) thick closed cells synthetic elastomeric foam insulation and wrapped with self-adhesive waterproofing tape. Condensate drain shall be insulated with 3/8" (10mm) thick closed cell synthetic elastomeric foam insulation. Contractor to provide minimum 25 mm dia Condensate Drain and terminate to nearest drain point.

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

All insulated refrigerant pipes exposed to atmosphere shall be provided with a cladding of 26 gauge (0.55 mm) thick G.I. or aluminium sheet metal with proper support system for cladding works. Cladding works shall be painted with one coat of primer and two coats of finish paint, as approved by the Engineer and as direct by Engineer in charge.

#### 2.4.1 Startup and Testing:

- a. Manufacturer's service technician to check alignment of bearings, drives and motors after installation to ensure that no misalignment exists, or make any necessary alignment adjustments prior to startup.

- b. The manufacturer shall furnish a start up check list to the Owner at least two months prior to start up. The list must be explicit as to the various items to be checked prior to start up.
- c. Before units are started up, manufacturer to pump new grease into bearing housings to force out old grease and provide adequate lubrication.
- d. Before acceptance of the equipment by the Owner, conduct all tests as required to demonstrate that the equipment operates mechanically, electrically and acoustically as specified.
- e. Conduct a satisfactory performance test in the presence of the Owner / Engineer incharge. Any units found to vibrate beyond acceptable levels must be rebalanced in the field at the Contractor's expense.

## **2.5 Spare Compressors and Parts:**

Minimum 10% spare shall be supplied as per Manufacturer's recommendations for two years continuous operation.

### **3.0 EXHAUST FANS:**

#### **3.1 GENERAL:**

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

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

#### **3.2 PROPELLER FANS:**

Shall be supplied of the quality indicated on the drawings. Propeller fans shall operate on 220V/1 phase/50 Hertz A.C. current. Fans shall be directly mounted on the motor, and shall operate without disturbing noise, during normal operation. The discharge side of the fan shall be provided with self-closing shutters. Propeller fans shall be as manufactured as specified in List of Approved Manufacturers.

#### **3.3 INSTALLATION:**

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

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

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

**4.0 SHEET METAL DUCTWORK AND ACCESSORIES:**

**4.1 SHEET METAL:**

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

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

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

Rectangular Ducting shall be fabricated according to the following dimensions:

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

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**4.2 SPLITTER DAMPER:**

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

**4.3 QUADRANT VOLUME DAMPER:**

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

#### **4.4 AIR DEFLECTORS:**

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

#### **4.5 FIRE DAMPERS:**

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

Fire dampers shall meet all UL and NFPA Standards and criteria for primary fire dampers in walls and floors with fire resistance rating of 4 hours and less.

#### **4.6 DUCT ACCESS DOORS:**

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

#### **4.7 DUCT TEST HOLES:**

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

#### **4.8 FLEXIBLE DUCT WORK:**

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

#### **4.9 BACKDRAFT DAMPER:**

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

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

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

#### **4.10 LOUVERS:**

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

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

#### **4.11 INSTALLATION:**

- 4.11.1 General: Sheet metal ductwork shall be constructed have galvanized sheet steel conforming to ASTM A-366-B2T. Unless otherwise approved ducts shall conform accurately to the dimensions indicated and shall be straight and smooth on the inside, with joints neatly finished. Ducts shall be secured to the structural slab in the building, and the method of anchoring and/or fastening is as detailed on the drawings. Ducts shall be constructed and installed so as to be completely free from vibrations under all conditions of operation. Layout

drawings required under the clause APPROVAL OF MATERIALS AND EQUIPMENT shall show, for suspended ductwork, the location of all supports typical details for anchorage and details for special anchorage.

#### 4.11.2 Duct Construction:

- (a). Curved elbows shall have a centreline radius not less than 1.5 times the width or diameter of the duct.
- (b). Joints for low velocity ducts shall be made substantially airtight, and no duct marks from air leaks shall show at duct joints, or connections to grills, registers and diffusers.
- (c). Laps at the joints for low velocity systems shall be made in the direction of airflow. Button punch or bolt connections in standing seams shall be spaced at fixed centers not greater than 150 mm (6"). Horizontal locks or seams of the type known as Button Punch Snap Lock, may be used in lieu of Pittsburgh Lock on low velocity systems.
- (d). Transformations shall be made with sides pitched not to exceed a maximum of 20°, 40° included angle, for diverging air flow, and 30°, 60° included angle, for converging air flow, or as indicated on the drawings.
- (e). Square elbows, fittings and branch take-off for low velocity shall be designed, constructed and installed as per recommendations in SMACNA Publications, "Low Velocity Duct Construction Standards".
- (f). Splitter dampers, Quadrant Volume Dampers, Air deflectors, fire doors and fire dampers, duct access doors and duct test holes shall be installed where shown on the drawings and where required for the proper operation of the system even though not shown on the drawings.

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

Bracing and jointing shall be done as per following table:

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

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

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

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



4.11.3 Flexible Duct Connections (Expansion Joint):

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

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

## **5.0 DIFFUSERS, REGISTERS AND GRILLES:**

### **5.1 GENERAL:**

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

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

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

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

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

### **5.2 DIFFUSERS:**

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

surface mounted diffusers, when necessary for air leaking-control. Suitable trim shall be provided for flush mounted diffusers.

### **5.3 REGISTERS:**

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

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

### **5.4 INSTALLATION:**

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

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

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

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

**6.0 ELECTRICAL WORKS:****6.1 ELECTRICAL WIRING:**

The Contractor shall be responsible for the complete power and control electric wiring required for HVAC Works and other areas as required for the system. The Owner shall provide electric supply DB (Contractor to verify this point). Wiring onwards from DB to all motors, controls, etc., shall be the responsibility of the Contractor. The Contractor will also provide separate DB for VRF system if required.

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

The Contractor shall verify the electric power given in motor control center drawings at the time of bidding. No additional cost and no variation or claim shall be entertained if Contractor supplied higher electric power equipments.

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

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

**6.2 CABLES:**

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

**6.3 ELECTRIC MOTORS:**

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

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

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

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

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

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

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

#### **6.4 MOTOR CONTROL CENTER CONSTRUCTION AND COMPONENTS:**

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

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

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

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

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

- (b) Construction: The control centre shall be consisted of 90 inches high and approximately 12-18 inches deep. The external panels shall be of flanged 14-gauge sheet steel. Side, top, back and full floor plates shall be rigidly joined by cross members and angle iron brackets.

Removable floor channels 1.5" x 3" shall be provided to support and mount the entire control centre.

- (c) Unit Compartments: provide each compartment with an individual front door.
- (d) Bus: Power shall be distributed horizontally within the control centre by a three phase electrolytic imported copper bus (99.7% purity), rated for the required Amperes continuous current and braced for minimum 40,000 ampere RMS asymmetrical short circuit current or as indicated on drawings. The bus shall be efficiently isolated from all wiring troughs and other working areas. Power within vertical sections shall be distributed by vertical copper bus bars. Bus bars shall be painted red, yellow and blue.

All the bus bars, internal wiring cables and other equipment shall be rated for 45°C ambient and bus bar end temperature of 65°C.

Provide copper ground bus of the required amperage but having not less than 200 amperes capacity in the base of the control centre permanently grounding the structure. Provide lugs as required for ground wire attachment.

- (e) Incoming & Outgoing Cable Termination: Provide 12" or more of wiring space just below the main bus for incoming cable. Provide space for outgoing cables through either top or bottom of all standard vertical sections.
- (f) Main Protective Device: The incoming line protection device unless otherwise specified shall be a circuit breaker of the frame size and ampere rating required for the power supply to the plant.
- (g) Motor Starters: All starters for single phased motors shall be automatic magnet direct-on-line types with adjustable overload cutout start/reset push button. Where electrical interlocking is required the starters shall be additionally provided with hand/off/auto switch and at least two auxiliary contacts for electric or electronic interlocking or as specified.

All three phase motor starters up to 7.5 HP shall be automatic magnetic direct-on-line type, with three adjustable overload cutouts, Ammeter low voltage cutout, single phasing preventer, stop-reset push button, HAND-OFF-AUTO switch and at least one auxiliary contact for electrical interlocking circuit or as specified.

The squirrel cage induction motors above 7.5 HP shall have star-delta type reduced voltage starters. The automatic starter shall have hand/off/auto switch, wherever electrical interlocking is required or where shown on the drawings. All starters should have three adjustable overload cutouts, Ammeter low voltage cutout, single phasing preventer, stop-reset push button, at least two auxiliary contacts for electrical interlocking circuit.

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

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

- (h) Unit Nameplate: Each unit shall be identified by a ½" x 4" engraved nameplate.
- (i) Motor Protection: Furnish and install all starters, overload heaters, as well as fuses unless specifically noted otherwise on the drawings. The selection of the overload heaters shall be based on the motor nameplate data. Fuses shall be of the dual element type, unless specifically noted otherwise. They shall be properly coordinated and in general sized according to fuse manufacturer's recommendations for the loads served.
- (j) Air Break Contractors: The contractors shall be suitably rated according to the motor output rating if not specified in the drawings and having rupturing capacity of 25 kA. Backup fuses to be provided if rupturing capacity is lower than the required.

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

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

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

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

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

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

The overload relays shall be of the soldered ratchet type.

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

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

#### **6.5 MOTOR CONTROL CENTER CONFIGURATION:**

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

#### **6.6 CABLE TRAYS:**

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

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

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

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

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



be in accordance with the Manufacturer's standard.

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

#### **6.7 STEEL CONDUIT AND ACCESSORIES:**

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

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

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

#### **6.8 GALVANIZED IRON PIPES AND ACCESSORIES:**

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

#### **6.9 INSTALLATION:**

- 6.9.1 General: The Contractor shall be responsible for the complete power, communication and control electric wiring of the HVAC and BMS Works. Wiring onwards from Client / Employer supplied DB to all motors, controls, etc., shall be the responsibility of the Contractor.
- 6.9.2 Electric Wiring & Earthing: The electrification work shall be carried out by a Licensed Electrician, authorized to undertake such work under the provision of Pakistan Electricity Act & Rules. The installation shall be carried out in conformity with Pakistan Electricity Act & Rules and the latest edition of I.E.E. Wiring Regulations. Any special requirements of the local Electricity Supply Company shall be complied with.

All power, communication and control wiring shall be duly tagged/ numbered on circuit for the ease of trouble shooting on wiring diagram and on circuits in MCC. All wiring in Plant Room shall be run in approval rigid and flexible steel conduits from the MCC to the motors, on the surface of walls, roofs & columns. Galvanized steel saddle and clamps of minimum 16 SWG, approved by the Consultant / Project Managers, shall be fixed to the surface using nylon plugs and galvanized steel screw, with a maximum distance of 3 ft. between clamps. Pull boxes, having sized of 4' x 4" & 2" deep and constructed of 18 SWG sheet steel shall be installed wherever required to limit the pulling length and shall be in a flexible steel conduit, provided with suitable brass glands and check nuts.

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

### 6.9.3 Steel and G.I Conduit

The minimum size of conduit shall be 20 mm.

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

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

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

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

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

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

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

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

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

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

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

#### 6.9.4 Testing:

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

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

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

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

Circuits above 250 volts

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

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

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

(c) Operational Tests:

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

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

**7.0 CLEANING, TESTING, BALANCING AND TEST DATA:****7.1 GENERAL:**

- a) The entire testing balancing and adjusting process to be thoroughly organized & planned. All activities, including the organization, procurement of required test instrumentation and the actual system should be scheduled as soon as practical after the installation has been completed.
- b) Testing and balancing shall be performed in accordance with NEBB (National Environmental Balancing Bureau) USA, code of practices and all final reports shall be signed and certified by the agency appointed to perform such works.
- c) The TBA agency must carryout the preparatory works which shall include the planning and scheduling of all TBA procedures, collecting the necessary data, reviewing the data collected, studying the system to be balanced, recording the published data on the test report forms, and finally, making preliminary field checks of the HVAC equipment and systems.
- d) The contractor shall submit six copies of the complete test procedure to the engineer for approval one month prior to the date of commencement of the balancing and performance test.

**7.2 CLEANING AND ADJUSTING:**

Equipment shall be wiped clean, with all traces of oil, dust or paint spots removed. Temporary filters shall be provided for all fans that are operated during construction, and after all construction dirt has been removed from the building, new filters will be installed.

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

**7.3 TESTING:**

- b) Duct Work: Ducts, plenums and casings shall be tested and made substantially air tight at static pressure indicated for the system before covering with insulation or concealing in the masonry. The term substantially airtight shall be constructed to mean that no air leakage is noticeable through the senses of feeling or hearing.

**7.4 BALANCING:**

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

**7.5 PERFORMANCE TESTS:**

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

**7.6 TEST DATA:**

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

**7.6.1 Air Balance:**

- (a) Fans: Size, type, speed in revolutions per minute, static pressure in inches of water, air quantity in cubic feet per minute, and motor load in amperes and voltage.
- (b) Ducts: Size, velocity in feet per minute, and air quantity in cubic feet per minute.
- (c) Air Outlets and Inlets: Size, velocity in feet per minute, and air quantity in cubic feet per minute.

**7.7 CONTROL SETTING:**

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

**7.8 OTHER EQUIPMENT:**

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

**7.9 TEST PROCEDURES:**

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

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

## 8.0 PAINTING AND FINISHING:

### 8.1 GENERAL:

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

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

Paint shall be applied to the following:

- (a) **Materials and Equipment:** All materials and equipment factory fabricated, imported or otherwise shall be provided with a fresh coat of paint, of same colour as the original factory-paint. Unless otherwise directed by the Consultant. The items covered under this head shall include chillers, air handling units, fan coil units, pumps, Cooling tower, fans, etc.
- (b) **Piping and Pipe fittings and valves etc.** shall be provided with two coats of red lead from an approved manufacturer. Chilled water piping shall be further provided with two finish coats. All valves etc. shall be painted in a colour, different from the colour on the adjacent pipe. Apply two coats of asphalt paint to all pipes laid in concrete or passing through concrete.
- (c) **Hangers and Supports** shall be provided with two coats of red iron from an approved manufacturer. All hangers and supports exposed to view shall be further providing with two coats of finish paint of an approved colour.

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

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

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

**8.2 STENCILING:**

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

**8.3 IDENTIFICATION TAGS:**

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

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

**8.4 PIPING AND DUCT WORK IDENTIFICATION:**

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



## 9.0 OPERATING AND MAINTENANCE INSTRUCTIONS:

### 9.1 BOUND INSTRUCTIONS:

Six complete sets of operating and maintenance manuals, duly approved by the Consultant / Project Manager, shall be supplied by the Contractor, prior to hand over of the project to the owner. Each set shall be permanently bound and shall have a hard cover. Each manual shall be inscribed with suitable legend for proper identification and use of the manual. The matter shall be legibly typed and/or shall be clear Photostat copies of the original documents, catalogues, etc. Flysheets shall be placed before instructions covering each subject. The instruction sheets shall be approximately 8 ½" x 11", with large sheets of drawings folded in. The manual shall be arranged in two parts, and shall generally conform to the arrangement shown below.

#### Part I – Systems

1. The system volumes shall be organized into divisions wherein each division represents a generic function. System shall then be classified under appropriate divisions.
2. The material for each system shall then be organized in sections descriptive of the following basic areas of information:
  - (a) Descriptive Information
  - (b) Operating Instructions
  - (c) Inspection and maintenance instructions.
3. Sections shall be organized to include the following categories of information:
  - (a) Descriptive Information:
    - (1) Function of service.
    - (2) Classification.
    - (3) Design Capability.
    - (4) Performance characteristics.
    - (5) Principal components.
    - (6) Distribution arrangement.
    - (7) Schematic diagram.
    - (8) Control diagram.
    - (9) Equipment data:
      - (a) Inventory designation.
      - (b) Manufacturer and Model.
      - (c) Size and rating.
      - (d) Pressure, speed, and temperature limitations.

(b) Operating Instructions:

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

(c) Inspection and Maintenance:

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

4. Reference Documents.

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

Part II – Equipment

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

Division Title

Air-conditioning & Ventilation	..	1
Controls	.. ..	2
Instruments & Accessories	.. ..	3
Motors	.. ..	4
Starters	.. ..	7

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

Air Conditioning & Ventilating	..	1.0
Fans – axial	.. ..	1.4
– centrifugal	.. ..	1.5
– propeller	.. ..	1.6
Filters – roughing	.. ..	1.7
– intermediate	.. ..	1.8
terminal	.. ..	1.9
Other equipment	.. ..	1.12

3. Coverage of section. Each section shall include the following manufacturer information:
- (a) Descriptive literature
    - (1) Catalogue cuts, brochures, or shop drawings.
    - (2) Dimensional drawings.
    - (3) Materials of constructions.
    - (4) Parts designations.
  - (b) Operating characteristics:
    - (1) Performance tables and charts.
    - (2) Performance curves.
    - (3) Pressure, temperature and speed limitations.
    - (4) Safety devices.
  - (c) Operating Instructions:
    - (1) Prestart checklist.
    - (2) Start-up procedures.
    - (3) Inspection during operation.
    - (4) Adjustment and regulations.
    - (5) Testing.
    - (6) Detection of malfunction.
    - (7) Precautions.
  - (d) Inspection Instructions and procedures:
    - (1) Normal and abnormal operating temperature, pressures and speed limits.
    - (2) Schedule and manner of operation.
    - (3) Detection signals.
  - (e) Maintenance Instructions and Procedures
    - (1) Schedule of routine maintenance.
    - (2) Procedures.
    - (3) Troubleshooting chart.
  - (f) Parts List.
  - (g) Spare parts.
    - (1) Essential inventory.
    - (2) Distributor Directory.
  - (h) Service Contracts.

**9.2 FRAMED INSTRUCTIONS:**

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

**9.3 FIELD INSTRUCTIONS:**

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

**10.0 TEST RUN:****10.1 GENERAL:**

After completion of the installation of HVAC System the Contractor shall carry out a two months test run in summer or as per direction of the Client / Employer or the Consultant / Project Manager. The certificate of substantial completion shall be provided on completion of the test run to the satisfaction of the Client / Employer or the Consultant / Project Manager and in keeping with the stipulations of relevant clauses of the Contract. This test run shall be constructed to form a part of the "Performance Tests" specified herein before.

**11.0 LIST OF APPROVED MANUFACTURERS:**

<b>S.NO.</b>	<b>EQUIPMENT / MATERIAL</b>	<b>RECOMMENDED MANUFACTURERS</b>
1	WALL MOUNTED DX SPLIT AIR CONDITIONING UNITS	a) DAIKIN b) TOSHIBA d) MITSUBISHI c) FUJITSU, GENERAL
2	COPPER PIPING	a) MUELLER, USA b) YORKSHIRE, UK c) CRANE ENFIELD, AUSTRALIA
3	GI SHEET FOR DUCTS	a) PAKISTAN STEEL b) JAPAN OR SOUTH AFRICAN MAKE c) ISL MAKE
4	AIR DISTRIBUTION OUTLETS, LOUVERS, VOLUME DAMPERS & FIRE DAMPERS	a) THERMEC, PAKISTAN b) ENGINEERING AIR PRODUCTS (EAP), PAKISTAN c) WESTERN AIR DUCT, PAKISTAN d) SHAN INDUSTRIES, PAKISTAN
5	FLEXIBLE DUCTS WITH INSULATION	a) ATCO, UAE b) AFS, TURKEY
6	FLEXIBLE DUCTS CONNECTOR	a) DURODYNE, USA b) DUCTMATE, USA
7	HANGERS & SUPPORTS AND FIRE STOPPING	a) LINK, TURKEY b) INKA, TURKEY c) INDEX, SPAIN
8	HVAC FANS	a) SYSTEMAIR, SWEDEN b) ELTA, UK c) SISTEVEN, SPAIN d) SODECA, SPAIN
9	ELECTRIC POWER CABLES	a) PAKISTAN CABLES b) NEW AGE CABLES c) POINEER CABLES
10	ELECTRIC COMMUNICATION & CONTROL CABLES	a) BELDEN, USA b) FIRECELL, ITALY c) PRYSMIAN, UK

11	a. PVC CONDUIT FOR ELECTRICAL WORKS (Power, Control & Communication Wiring - CONCEALED / RECESSED Application)  b. GI CONDUIT FOR ELECTRICAL WORKS (Power, Control & Communication Wiring - SURFACED / EXPOSED / ABOVE FALSE CEILING Application)	a) DADEX, PAKISTAN b) HILAL, PAKISTAN c) IIL, PAKISTAN d) PREMIER, PAKISTAN
12	MOTOR CONTROL CENTER (MCC), DISTRIBUTION BOARD DB)	a) LIBRA SWITCHGEAR, PAKISTAN b) BILAL SWITCHGEAR, PAKISTAN c) HUSSAIN & COMPANY, PAKISTAN
13	PANELS FOR MCC & DB	a) LIBRA SWITCHGEAR, PAKISTAN b) BILAL SWITCHGEAR, PAKISTAN c) HUSSAIN & COMPANY, PAKISTAN
14	VIBRATION ISOLATION	a) KINETICS, USA b) MASON, USA

# **Technical Specifications**

## **Electrical Works**



## SECTION – E - 1 GENERAL SPECIFICATIONS

### FOREWORD

This document is to describe the minimum requirements for the equipment and installations and to ensure that the Contractor is fully aware of his duties to perform the required works, in accordance with the terms of the Contract.

### 1. SCOPE OF WORK

The works related to the electrical system which are included in the scope of this Contract are shown on the Drawings, stated in the Particular Specifications, Bill of Quantities and explained in these specifications. The works shall broadly include but not limited to the following:

- a. Low Voltage Switch Board /Distribution Boards (Section - E - 2)
- b. Low Voltage Cable and Wires (Section – E- 3)
- c. Conduits and Pipes (Section – E- 4)
- d. Wiring Accessories (Section – E - 5)
- e. Lighting Fixtures (Section – E - 6)
- f. Voice & Data Communication Systems (Section – E - 7)
- g. Earthing System (Section – E - 8)
- h. Cable Tray, Ladder and Trunking (Section – E - 9)
- i. Public Address System (Section – E – 10)
- j. CCTV System (Section – E – 11)
- k. Fire Alarm System (Section – E – 12)
- l. Access Control System (Section – E – 13)
- m. UPS (Section – E – 14)
- n. Self-Contained Emergency Lights (Section – E – 15)
- p. Lightning Protection System (Section – E – 16)

All material and equipment supplied by the Contractor shall be new and in all respects conform to the high standards of Engineering design, workmanship, performance and function as here in specified and fully meet the quality level and rugged requirements of the specifications.

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, shall be considered to have been so specified and accordingly shall be provided by the Contractor as part of the Contract.

The Contractor shall be solely responsible for ensuring proper functional requirements of various equipment and 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 Owner or his representative, to achieve proper coordination with various equipment offered in the bid and also those installed by others.

Approval of the Contractor's supplied equipment / installation works shall not relieve the Contractor of any of his obligations or liabilities under the Contract, except insofar as provided under the conditions of the Contract.

## **2. RULES AND REGULATIONS**

The entire electrical installation / work shall be carried out by licensed contractor, authorized to undertake such work under the provisions of Electricity Act 1910 and The Electricity Rules 1937 as adopted and modified up to 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, the Contract documents, the Electricity Rules 1937 and bye-laws that are in force from time to time. Any discrepancy between these specifications and any other rules and regulations shall be brought to the notice of Owner or his representative, and his decision 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 Electric Company shall be complied with.

## **3. STANDARDS**

All works, equipment and materials shall conform to:

On the one hand:

The specification recommended practices, official standards and codes the non - restrictive list of which is given below.

International Electro-technical Commission (IEC)

British Standards (BS)

National Electric Code (NEC)

Local Regulations

In the event of conflict between standards, the most stringent shall prevail.

Whenever the electrical equipment to be installed, does not hold national standards, the Contractor shall take into account the specific standards chosen by the Owner and make sure that the equipment he has to install, meets these standards.

In addition, even if no mention is stipulated in this specification, it is implied that the equipment be tropicalized, if required, by the conditions of the site of installation.

In any case, the standards and codes to be taken into consideration are those in force at the date of delivery.

## **4. INSTALLATION AND SERVICE CONDITIONS**

### **4.1 Site 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:

- |  |   |             |
|--|---|-------------|
| a. Maximum outdoor ambient temperature | : | 45 degree C |
| b. Minimum Indoor ambient temperature  | : | 0 degree C  |
| c. Maximum relative humidity           | : | 90 %        |
| d. Minimum relative humidity           | : | 26 %        |

#### **4.2 Service Conditions**

Equipment shall be designed and built for continuous service with a minimum of supervision and maintenance.

### **5. MAIN ELECTRICAL CHARACTERISTICS**

#### **5.1 Power Supply System**

Unless otherwise specified elsewhere, all equipment and material shall be designed to operate and function satisfactorily with the following minimum requirements without any de-rating:

- Voltage 400  $\pm$  10%
- Phase 3, 4 wire system
- Frequency 50 Hz.  $\pm$ 2 Hz.

#### **5.2 Degree of Protection of Enclosures**

For indoors, IP42 minimum degree of ingress protection of the enclosures against contact with line or moving parts and against ingress of solid foreign bodies or liquids, shall be selected, in accordance with IEC 60529. For outdoor, IP 55 minimum degree of ingress protection of the enclosures shall be provided.

### **6. GUARANTEE**

The Contractor shall furnish written grantee which should clearly state that the works he will carry out as well as the materials he will supply, meet with this specification and that compliance thereto constitutes an official clause, added by implication to the general conditions of his offer when signing the Contract.

Guarantee shall also be for replacement and repair of part or whole of the equipment which may be found defective in material or workmanship. The grantee shall cover the duration of Maintenance Period as defined in the conditions of the Contract. This guarantee shall not relieve the Contractor of his obligations and he will fully be 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.

The Contractor shall acquaint himself fully with the existing conditions and limitations at site and all works necessary to complete the project under the Contract, to be carried out by the Contractor.

### **7. EXCEPTIONS TO SPECIFICATION**

Any exception or deviation from this specification or the codes and standards shall be listed separately in the Contractor's "List of Deviations". Any exception, which shall not be listed, shall not be considered later.

### **8. AVAILABILITY OF SPECIFICATIONS, DRAWINGS AT SITE**

The Contractor shall assume at his own cost the permanent availability of this

specification and drawings on site where applicable.

**9. DISCREPANCIES IN TENDER DOCUMENTS AND DRAWINGS**

The Contractor shall carefully examine the documents and drawings and if he finds any discrepancies or omissions from the specifications, bill of quantities or drawings, or is in doubt as to the meaning, he shall at once notify the Owner or his representative for receiving his instructions before proceeding with the works. If such defective or modified work is carried out by the Contractor on his own, he shall rectify the same at his own cost.

**10. MEASUREMENT OF WORKS**

The quantities set out in the bill of quantities are the estimated quantities and they shall not be taken as actual and correct quantities of work to be executed by the Contractor. The Contractor shall carry out actual measurement of works at the site.

**11. INSTALLATIONS DETAILS**

The locations, routings, installation heights, detail etc. for electrical equipment are indicated on the drawings. If any information is not stated on the drawings or wherever modifications are required the Contractor shall obtain prior instructions from the Owner or his representative.

**12. DRAWINGS AND DATA**

The Contractor shall provide dimensional outline drawings, arrangement drawings and technical data for the equipment offered, for the approval of Owner or his representative.

**13. PRIOR APPROVAL OF SHOP DRAWINGS, MATERIALS AND EQUIPMENT**

The Contractor shall provide shop drawings for the electrical installations showing the exact routes of all underground cables and ducts, the exact run of all conduits and trunking, draw-in and junction boxes, the number and size of wires in each conduit, the final connection arrangements at distribution boards and the details of ducts for the approval of consultant / Owner's representative before commencing any portion of the works. All such working drawings shall be submitted in suitable number of copies as indicated in the particular conditions and within the periods stipulated below:

a. **Cable entry ducts into buildings:**

Working drawings shall be submitted within two weeks of handing over the site.

- b. All other working drawings shall be submitted to the Engineer against signed receipt and dated within two months of signing the Contract. Should however the Contractor be obliged to install electrical conduits prior to this period then he shall submit the relevant working drawings at least two weeks prior to the proposed date of commencement of the work. The Contractor shall submit the program indicating the dates on which coordination in different sections will take place, together with the submission of the working drawings. The Engineer shall arrange to return to the Contractor at least one week prior to the commencement of concreting of the section, his comments or approval of the working drawings.

The Contractor shall supply detailed specifications, dimensional drawings, etc., of equipment that he proposes to supply and install.

Where this Contract requires the approval of Engineer to material and goods, the Contractor must seek to obtain this approval within eight weeks after signing of the Contract. No extension of time shall be granted for non-availability of material or goods if this clause is not complied with. Approval of the Engineer does not relieve the Contractor of placing his orders in due time for the materials he needs to complete the Contract on time. The approved samples shall be retained on site for comparison with commodities used in works and removed when no longer required.

#### **14. MATERIAL ORIGIN AND QUALITY**

The material and equipment shall be purchased from Consultant / Owner's agreed suppliers.

The consultant / owner shall retain the right to demand, at any time, the indication of origin of the materials, and to eventually refuse products, the origin of manufacturing of which have not been previously agreed to without consideration of quality.

On specific agreement of the Owner, the materials may be delivered progressively to the field, but in such a manner as to allow sufficient time for their reception.

When choice of manufacturer is allowed for any particular commodity the Contractor shall obtain the whole quality required to complete the work from one manufacturer or obtain approval of any change in source of supply. He shall produce written evidence of sources of supply when requested to do so by the Engineer.

#### **15. IDENTIFICATION OF EQUIPMENT**

For each piece of equipment, identification label shall be fitted in front of the casing. The label shall have block letter 7mm high, black on white back ground of trifoliate and fixed with screws.

#### **16. 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.

#### **17. FACTORY TESTS**

All equipment supplied by and installed as part of the Contract such as distribution boards and like shall be fully tested at the manufacturer's works to the requirements of appropriate standards called for later in the particular specification.

The Contractor shall inform the Engineer in writing about the date and time of test of each equipment at least two weeks in advance. The witnessing of test by the Owner 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 6.0. All test results in the form of certificate of test / test record certificates, signed by all the witnesses, for each item in the scope of Contractor's supply shall be supplied to the Engineer within seven days of the test date, and in any event before delivery to the site.

All expenses for carrying out the tests and witness by the Owner or his representative shall be borne by the Contractor and deemed to have been

included in the tender bid.

**18. STORAGE**

The Contractor shall store the equipment in such conditions that it cannot be damaged, i.e., in a dry warehouse. As particular concerns; fragile components, these shall be stored on shelves in their original packing, fitted with identification labels so as to avoid unnecessary manipulation or handling.

The Contractor shall handle, store and fix each commodity in accordance with the manufacturer's recommendations. He shall inform the Engineer if these conflicts with any other specified requirement and submit copies of manufacturer's recommendations to the Engineer when requested to do so.

**19. LABOR AND STAFF OF CONTRACTOR**

The Contractor shall provide / furnish and arrange for:

- Skilled and unskilled labor required for performing the works in accordance with the technical specifications and drawings within the agreed time schedule.
- Supervisory technical staff with appropriate experience and requisite expertise to ensure quality of work performed.
- Supervisory administration and clerical staff to ensure smooth functioning of the activities at site.
- Construction equipment, meggers, tools, etc.

The Contractor shall supply all labor, materials and equipment necessary for the installation of low voltage distribution boards, cables, lighting and power equipment, together with all other apparatus shown on the drawings and as detailed in the Particular specification.

**20. SMALL INSTALLATION MATERIAL**

The Contractor shall supply all small installation and consumable materials such as nuts, bolts, washers, shims, angles, leveling materials, insulation tape, solder, PVC strap-on or heat shrinkable type cable tags, cable ties, bushes, sealing compound, Avometer, electrical testing and measuring instruments, etc., and all such other material not listed in BOQ, required for complete installation as intended by the specification and scope of works.

**21. INSTALLATION INSTRUCTIONS - GENERAL**

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 Contractor not following the manufacturer's instructions shall be corrected and repaired by the Contractor at his own cost.

**22. ASSOCIATED CIVIL WORKS**

The expression 'Associated Civil Works' shall mean civil work to be carried out by the Contractor under the direction of the Engineer in connection with the Electrical Service.

The Contractor shall prepare accurate drawings giving details of all holes, fixings, bases and other civil work requirements and shall be responsible for their accuracy. The cost of preparing shop drawings shall be considered to have been so specified in the tender price.

The following is a summary of the work to be carried out by the Contractor:

- a. The cutting and forming of holes for conduits or pipes, or conduit or pipe fixings through walls, floors, ceilings, partitions, roofs, etc., and making good after the work is sufficiently advanced.
- b. The building of concrete and / or brick ducts in floors, walls, etc.
- c. The formation of concrete bases, etc., for equipment
- d. Excavation forming for underground services of ducts and courses and then covers it.
- e. The cutting or forming of chases, recesses, etc., in floors, walls, etc., for conduits and fittings in and making good.
- f. Excavation for and laying of cable carrying pipes.
- g. The building in of brackets and supporting bars or other form of conduit or pipe suspensions.
- h. The painting of all pipes, tube and conduits etc. after fixing unless specified to the contrary.
- i. The providing and building in of sleeves through slabs and walls.

In general all required holes through walls, floors and beams for pipes and ducts will be left out by the Contractor during the process of building.

Where conduits, pipes or fittings are fixed to concrete or woodwork by means of saddles or clips, the Contractor shall himself execute the work necessary and the cost of such work shall be considered to have been so specified in the price.

Cutting, fitting, repairing, patching or plastering and finishing of carpentry work shall be done by craftsmen skilled in their respective trades, when cutting is required it shall be done in such a manner as not to weaken structure, partitions or floors. The holes required to be cut must be directed without breaking out around the holes. Where patching is necessary in finished areas of building, the Engineer shall determine the extent of such patching or refinishing.

### **23. TESTING - GENERAL**

Upon completion of installation, at least seven days notice is to be given of intention to perform any test. The Contractor shall perform all static, semi-dynamic (by simulation), and dynamic field testing on all the equipment and systems.

All tests shall be conducted in the presence of the Engineer for the purpose of demonstrating equipment or system compliance with specifications. The Contractor shall submit for Engineer's approval complete details of tests to be performed describing the test 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 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 obligations of Contract.

In addition to installation testing, the Contractor is to carry out operation testing of all sections and is to clean, set, calibrate and fully commission, demonstrate and hand over to the Owner the entire Contract works in a thoroughly complete and operational state to the satisfaction of the Engineer.

The acceptance - provisional or final- shall be made by the Owner. This reserves him the right to be represented or assisted by a representative or an organization ( whether official or not) of his choice, which may decide on his behalf any repairs deemed necessary resulting from lack of observations of this specification, or of the rules and standards. In addition, he may judge the quality of the works and the materials supplied.

This remains in force in case of sub-contracting.

The Contractor shall formally engage his direct responsibilities to the Owner or his representative, and likewise, shall assume all responsibility for work performed by sub-contractors and materials he has supplied and installed.

### **23.1 Insulation Resistance Test**

Insulation resistance test shall be made on electrical equipment by using a megger of 1000 volts for circuits between 250 and 500 volts. The insulation resistance of distribution boards, cables, etc., shall be as per IEC, IEEE, BSS and Pakistan Electricity Rules.

The distribution boards shall be given an insulation resistance measurement 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 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.

### **23.2 Earth Resistance Test**

Earth resistance tests shall be made by contractor on the earthing



system, separating and reconnecting each earth connection as may be required by the Engineer. 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 E.C.C. together with the resistance of the earthing lead measured from the connection with earth electrode to any other position in the completed installation shall not exceed one ohm.

Earth resistance test shall be performed as per Electrical Inspector's requirements. Where more than one earthing sets are installed, the earth resistance test between two sets shall be measured by means of Resistance Bridge Instrument. The earth resistance between two sets shall not exceed one ohm.

### **23.3 Switchgear**

Each circuit breaker shall be operated electrically and mechanically. All interlocks and control circuits shall be checked for proper connections in accordance with the wiring diagrams given by the manufacturer.

The Contractor shall properly identify the phases of all switchgear and cables for connections to give proper phase sequence.

Trip circuits shall be checked for correct operation and rating of equipment served. The correct size and function of fuses, disconnect switches, number of interlocks, indicating lights and alarms shall be in accordance with approved manufacturer drawings. Nameplates shall be checked for proper designation of equipment served. Protective relays shall be tested and set at site prior to commissioning of the equipment.

### **23.4 Special Systems Tests**

The special systems such as telephone, intercom, etc., shall be tested according to the procedures laid down in the respective sections of the technical specifications. However, any specific tests recommended by the manufacturer shall also be carried out as approved by the Engineer.

### **23.5 Complete 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.

## **24. ELECTRICAL CONNECTION**

Electrical connection for each building shall be supplied by other but necessary arrangement coordination to be done by this Contractor.

## **25. AS BUILT DRAWINGS AND SERVICE MANUALS**

A record shall be kept as the work proceeds of any work not in accordance with the working drawings, and upon completion of the work, the Contractor

shall prepare the following drawings and forward them to the Engineer for approval:

- a. Duplicate prints of as built single line diagram of the main and sub main distribution network, indicating all cables, their size and type, and the rating of all protection devices such as circuit breakers, fuses, etc.
- b. Duplicate prints of as built drawings of lighting, power, telephone, fire alarm, as applicable.
- c. Duplicate prints of as fixed control and wiring diagrams for the equipment installed as part of the Electrical Contractor works.

After these drawings have been approved, the Contractor shall supply two prints on paper of each and insert these in the operating and maintenance manual specified below.

The Contractor shall submit to Engineer for approval a sample of manufacturer instructions for installation, testing, commissioning, operation and maintenance manuals including manuals of spare parts and tools of the equipment. Upon acceptance, the Contractor shall supply three copies to the Engineer for forwarding to the Owner. These manuals should be in properly bound form. At least two copies of the documents shall be submitted in original. The installation instruction shall be submitted two weeks prior to commencement of installation of each equipment, and operation and maintenance instruction at 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.

## **26. WORK COMPLETION**

The Contractor shall further make good, repair, replace all defective works and clear away on completion and leave all installations in perfect working order and to the satisfaction of the Owner or his representative.

## **27. PAYMENT**

No separate payment shall be made for work involved within the scope of this section unless specifically stated in the Bill of Quantities or herein.

## SECTION - E - 2 LOW VOLTAGE SWITCHBOARDS / DISTRIBUTION BOARDS

### 1. GENERAL

#### 1.1 Purpose

This section together with its appending document covers the minimum requirement for the design, construction and performance of factory built assemblies of LV switchboard.

#### 1.2 Scope of Work

The work under this scope consists of supplying, installation, testing, connecting and commissioning of all material and services of the complete switchboard as specified herein and/ or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

#### 1.3 Standards

Switchboards shall comply with Section - E - 1, Clause 3.  
Particular reference shall be made to:

IEC 60027	Letter symbols to be used in Electrical technology.
IEC 60051	Direct setting electrical measuring instruments.
IEC 60073	Colour for indicator lights and push bottoms
IEC 60158	LV Switch gear and control gear.
IEC 60185	Current Transformers.
IEC 60186	Voltage Transformers.
IEC 60269	LV fuses.
IEC 60439	Factory built assemblies of LV switch gear and control gear.
IEC 60529	Degree of protection provided by enclosures.
IEC 60617	Graphic symbols for diagrams.
IEC 60947-2	LV Switch gear and Control gear.
BS 951	Earthing Clamps
BS 1433	Hard drawn bare copper conductor for earthing.
BS 2874	Nuts, Bolts, Washers and Rivets for use on copper.
BS 6346	PVC Insulated Cables.
CP 1013	Earthing

Any other standard referred to in above standards or these specifications.

#### 1.4 Installation and Service Conditions

For general site conditions refer to Section - E- 1, Clause 4.

Switchboard shall be installed indoor. The equipment shall be capable of operation under the prevailing ambient conditions without any deleterious effect of any kind. Switchboard shall be suitable for continuous operation at full load rating under combined variation of both voltage and frequency as stated in Section - E-1, Clause 5.1.

Transient voltage depression down to 80% of rated voltage shall not affect the performance of the equipment and dip voltage must be within permissible limit.

## 2.0 MAIN ELECTRICAL CHARACTERISTICS

### 2.1 Power Supply System

Main characteristics of power supply system applicable to all switchboards are:

- Voltage 415 V  $\pm$  10%
- Phase 3  $\phi$ , 4 Wire.
- Frequency 50 Hz.  $\pm$  2 Hz.
- Neutral system Solidly grounded.
- Peak asymmetrical SCC To be specified by the bidders.
- RMS symmetrical SCC To be specified by the bidders.

Main characteristics of auxiliary supply system are:

- Control / Command system 24 VDC.
- Space heater system 230 VAC.

### 2.2 Ratings

The equipment shall be capable of carrying the specified current on a continuous basis of 24 hours. Per day, without exceeding the permitted temperature.

The current ratings of all equipment must be guaranteed at the specified design temperature. Equipment shall be fully rated and constructed for withstanding, making and breaking the specified short circuit duty.

Pins of auxiliary circuits shall be sized for a rated circuit of 10 Amp Minimum.

## 3. GENERAL REQUIREMENTS

### 3.1 Concept

The Switchboard shall be of standard, prefabricated metal clad cubicle(s), floor mounting type/wall mounted, totally enclosed, dead front, dust tight and vermin proof requiring front access only. It shall complete in all respects with material and accessories, factory assembled, tested and finished all according to the specifications and to normal requirements. For indoor installations the international classification shall be IP42.

The Switchboard with all components and accessories shall be suitable for front operation only and shall:

- have a rated service short service breaking capacity, Ics at 400 VAC, conforming to IEC 60947-2 unless otherwise stated on the drawings.
- be provided with adequate clearance from live parts so that flash over cannot be caused by switching, vermin, pests, etc.
- have all components rated for insulation class 600-volt minimum.
- be designed for flush mounting of all instruments on the front side.
- have all incoming or outgoing connections from the top or

bottom as required. Have the components mounted so as to facilitate ease of maintenance from the front. Have common lamp test facility for all lamps.

- have wiring diagram on the inside of door of the switchboard. Be labeled with nameplate on the front side of door.
- have arrangements for extension of switchboard in future.

### **3.2 Accessibility**

Switchboard shall preferably be arranged for bottom cable entries. Adequate space must be provided for cable entries and termination. It shall be possible to work easily and safely on cable of a main or control outgoing circuit in OFF position with the remainder of the board alive.

Adequate system shall be provided for installation and clamping of cables inside the cable compartment. Position of terminals and cables shall allow use of clamp ammeter.

Power and Control cable termination shall avoid obstruction to other cable termination and provide easy access for terminating cables. Cable supports shall be provided to avoid undue strain on cable termination. Easily accessible locations shall be reserved in the compartment for measuring transformers.

### **3.3 Heaters**

Space heaters shall be provided for prevention of moisture in each cubicle. Heaters shall be wired together and shall be automatically controlled to avoid over heating the equipment. Heater shall be suitable for operation on 230 VAC supply from an external source (to be provide in main Distribution Board)

### **3.4 Name plates**

On the front side, a name plate shall be provided at the top to indicate the name of manufacturer, system voltage and frequency and the current carrying capacity of switchboard.

Each breaker shall have a circuit identification label fitted below the breaker aperture or as suitable.

Drawing indicating the branch circuit names, breaker elements, cable sizes and connecting services shall be placed in a clear plastic pocket provided at the back of the front access.

Labels described shall have block letters 7 mm high on a white back ground, to be made from traffolite and be fixed with screws.

Each incoming and outgoing circuit shall also be labeled with name plate 75 mm x 15 mm, as described above on the front side of door.

## **4.0 MECHANICAL DESIGN**

### **4.1 General Construction**

The switchboard shall be fabricated, welded; grinded, finished with angle iron framework and clad with 14 SWG MS sheet, to form a rigid, free standing, flush mounting fronted assembly.

It shall be suitably divided into panels and compartments for accommodating the required number of circuit components, instruments and accessories. Each compartment shall be fully partitioned from its neighbor both horizontally and vertically, allowing safe cable routing / termination without shutting the switchboard down.

All live parts within cubicles, compartments or modules, which have to be accessible during normal maintenance operations, shall be adequately protected and / or barred to ensure protection of works and to avoid accidental contact. Barriers may be rigid, transparent, insulating material fitted with warning labels.

The doors shall be provided with hinges on the left-hand side and locking handles on the right hand side for fastening the door. The front assembly shall be fastened to the enclosure by means of self locating fasteners for quick and easy fixing.

All holes, cutouts shall be tool or jib manufactured and free from burrs and rough edges. All structural components shall be of standardized design to provide complete uniformity and inter change ability of common parts. Removable gland plates shall be provided at top and / or bottom as required.

The switchboard shall be supplied complete with foundation bolts and other installation materials as recommended by the manufacturer. Proper size cable clamping channels with galvanized steel clamps and brass cable clamps respectively for unarmoured and armoured cables shall be provided.

The cabling inside the Switchboard shall be suitably numbered and harnessed by means of straps or cords. Wiring to door mounted components shall be in flexible PVC conduit. All indicating, control and selecting equipment shall be suitably arranged and clearly labeled with indelible labels indicating the rating of fuses, switches, etc.

All metal work of the switchboard shall be cleaned down to bare shining metal, phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of colour RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

#### **4.2 Bus Bars**

Bus bars and droppers supported on non - hygroscopic material are to be high conductivity electrolytic tinned copper, completely isolated and mechanically braced and rated to withstand the specified short circuit currents for one second duration.

Bus bars and droppers shall be housed in a separate compartment and shall be clearly marked with their respective colors. Bus bars shall be provided for three phases, neutral and multi - terminal earth. The temperature rise shall not exceed 50 degree centigrade at rated current. Neutral bus assembly shall consist of outgoing screw terminals with one terminal for every MCCB / MCB.

Neutral Bus bar should be of same ampere rating as phase bar.

Removable metal covers on the bus bar chamber shall be provided with suitably sized labels at regular intervals, fixed with self tapping screws and warning of live metal work.

All bus connectors shall be tinned plated connections and joints. Horizontal bus bars shall be of the same current rating throughout their length.

### 4.3 Earthing

A copper earth bar of suitable section for the specified fault level shall extend the entire length of the Switchboard. Provisions shall be made for possible future extensions at both ends.

Earthing facilities shall be provided on each incoming and outgoing unit to permit earthing of the connections.

All metallic non-current carrying parts of the Switchboard shall be bonded together and connected to the Switchboard's earth bar.

Each circuit wiring shall be green / yellow colour. Earthing mass continuity between withdrawable parts and fixed frame shall be correctly ensured whatever the withdrawable part position.

Provision shall be made adjacent to cable termination for earthing cable armour to the earth bus bar.

Earthing switch shall be provided wherever mandatory as per rules and regulations / codes and standards and shall be manually operated. An interlocking system shall provide the following locking and safety functions :

- impossibility of closing the earth switch if the switching device is closed.
- visual check of earthing switch positions to be possible.
- possibility of locking the earthing switch operating handle in open and closed position.
- the earthing of the bus bar shall be done manually by the operator without provision of general earthing system.

### 5.0 DISTRIBUTION BOARDS

The enclosure of the LV Distribution Board shall be fabricated from electro-galvanized / zinc coated sheet steel.

The LV Distribution Board shall be fabricated with 16 SWG sheet steel recess mounting. All components shall be installed on a common component mounting plate made of 14 SWG sheet steel inside the enclosure and protected from the front with screwed sheet steel front plate. The door and dead front covers shall be made of 14 SWG sheet steel. The door shall be fully gasket with hinges on the left hand side and locking handle on the right hand side for fastening the door. The locking handle should be detachable. The dead / front assembly shall be fastened to the enclosure by means of self - locating fasteners for quick and easy fixing.

The distribution board 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 accommodating the cables and conduits may be provided. The box shall be of the same material and finish as the Distribution Boards.

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 Distribution Boards at two points. Flexible copper strip shall be provided for earthing of the door of Distribution Board.

Neutral bus assembly shall consist of outgoing screw terminals with one terminal for each MCB. All holes, cutouts, etc., shall be tool or jib manufactured and free from burrs and rough edges. Removable gland plates shall be provided at both the top and / or bottom, as required.

The cabling inside the distribution board shall be suitably numbered and harnessed by means of straps or cords. Wiring to door mounted components shall be in flexible PVC conduit. All indicating, control and selecting equipment shall be suitably arranged and clearly labeled with indelible labels indicating the rating of fuses, switches, etc.

All metal work of the distribution board shall be cleaned down to bare shining metal, phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of colour RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

## 6.0 COMPONENTS

The switchboards shall be provided with all components as specified or shown on the Drawings and as necessary for the satisfactory operation of the Switchboard and of the electrical system. Typical specifications are given here under :

### 6.1 Moulded Case Circuit Breaker

These shall be three pole 400 / 500 volts rating shown on the drawings. The breakers shall have both time delay over current and instantaneous short circuit protection.

The MCCBs shall be installed such that their switching levers are accessible through the dead front plate for operation. Circuit numbers / designation on all circuits shall be conspicuously marked to facilitate connection and maintenance.

The breaker shall have quick make - quick break toggle mechanism with positive 'ON', 'OFF' and intermediate 'Tripped' positions.

Trip mechanism shall be trip free on overload or short circuit ensuring that the breaker will not close / remain close even if the close command is given while the circuit breaker has tripped due to short circuit or continuing overload.

### 6.2 Miniature Circuit Breaker (MCB)

The MCBs with current rating from 3 to 100 Amps. shall be conforming to



BS EN 60-898 or IEC 60947-2. The circuit breakers shall be suitable for DIN-rail mounting, maintenance-free and fully tropicalized. The MCBs shall be designed for horizontal or vertical mounting, or reverse feeding, without any adverse effect on electrical performance.

The operating mechanism shall be quick make, quick break type, trip free, with all poles opening and closing simultaneously (except for the neutral pole, which if required shall be of the advance-closing and late-opening type). The operating toggle shall clearly indicate the ON and OFF/TRIP positions.

The individual operating mechanism of each pole of a multiple MCB shall be directly linked within the MCB casing and not by the operating handle.

Each pole of the MCBs shall be provided with bimetallic thermal element for overload protection and a magnetic element for short circuit protection.

### **6.3 Earth Leakage Circuit Breakers (ELCB)**

ELCBs shall be four pole, current operated type with tripping current of 0.3A and tripping time not more than 0.1 seconds.

### **6.4 Load Break Switch and Contactor**

Load Break Switches and contactors shall be of AC3 type for motor loads. Air circuit breakers above 630A shall be housed in separate cubicles. Aluminium plate shall be provided for cable entry to ACBs / MCCBs cubicles of 630A and above rating.

## **7 POWER FACTOR IMPROVEMENT PLANT**

The power factor improvement plant shall be used for improving the power factor of the system. The plant shall be automatic-cum-manual.

The power factor improvement plant shall be aligned with main LT switch board and it shall be a part of that LT switchboard as shown on the drawing. The capacitors shall be suitable for three phases, 415 volts 50 Hz system and shall be self cooled, designed for indoor use in tropical climate for maximum ambient temperature of 45 degrees centigrade and relative humidity 90%. The capacitors shall be in the form of banks divided for 12 stages, 6 stages and 4 stages. Each capacitor bank unit shall be 25 and 50 KVAR. The total KVAR capacity shall be as indicated on the drawings. Each capacitor unit shall be complete with discharge resistors and internal fuses and shall be connected with control panel with proper size of single core PVC insulated cables.

The panels shall be supplied complete with a set of 3-phase, full capacity, isolated tinned copper bus bars, interconnections, risers, designation labels, cable sockets, holding down bolts, wiring with cleats and ferrules, earthing sockets and studs, etc. Each control panel shall comprise.

- 1 No. Multi stage power factor correction relay for automatic/manual control.
- 1 No. 3-phase, 4 wire, 415 volts, unbalanced load power factor indicator.
- 1 No. Auto-off-Manual selector switch
- 1 No. Current transformer with 5 amps secondary current, having suitable output burden and accuracy.

3 Nos. Instrument protection fuses.

Following equipment shall be provided for every 250 KVAR capacitor bank:  
1 No. 630 amps, triple pole 415 volts air break contactor with auxiliary contacts (2 N.O+2 NC) Contractor shall be suitable for AC 3 duty.  
1 Set of 2 Nos 630 Amps H RC back-up fuses with base and carrier.  
1 Set of ON and OFF push buttons.  
1 No. Red lamp for "On" indication of the contractor.

### **7.1 Requirement of Capacitor Banks**

According to IEC-83 1 -1 and 831-2.

Fully insulated, terminals to be shielded by a cover.

Dielectric: Plastic poly-propylene, impregnated.

Electrodes: Aluminium coating vacuum metalized.

Safety features: Self healing. Over pressure tear-off fuse.

Withstand switching operations safely.

Maximum in rush current 200 times rated current.

Loading capacity: 1.1 times rated voltage. 1.3 times rated current at delta max.

Overloading capacity 1.5 times rated output at delta max.

Acceptable tolerances - 5/+ 10% of rated output at rated frequency.

Static life expectancy > 100,000 operating hours.

Test Specifications: Terminal versus terminal with an AC voltage 2.15 times rated voltage for 10 seconds duration. Terminals to casing with an AC voltage of 3 KV for 10 seconds duration.

## **8. PARTICULAR COMPONENT REQUIREMENTS**

### **8.1 Current Transformers**

Current transformers shall comply with the requirements of IEC 60185 (or equivalent).

Current Transformers shall be polyester resin insulated, ring type, air cooled having transformation ratio as indicated on the drawings. The current Transformers shall be of suitable burden having accuracy class 1.0. The Current Transformers shall have rated secondary current 5A / IA as required.

Current Transformers shall mechanically and thermally withstand the specified short circuit capacity. Test terminal blocks shall be provided for current Transformer secondary circuits having short circuiting provisions to allow portable apparatus to be connected.

### **8.2 Voltage Transformers**

Voltage transformers shall comply with the requirements of IEC 60186 (or equivalent) and shall be of the same accuracy class as Current Transformers.

Voltage Transformers shall be equipped with primary fuses with an interrupting capacity of the incoming circuit breakers. Test terminal block shall be provided for each Voltage Transformer system.

### **8.3 Ammeters and Voltmeters**

Indicating instruments shall be semi-flush Switchboard type, moving Iron, spring controlled with standard scale having white background and

black graduations and markings. The front dimensions shall be 144 x 144 mm for instruments on incoming side and 96 x 96 mm on all outgoing circuits.

Indicating instruments shall be 1.0 class percent of full scale basic accuracy class in accordance with IEC 60051.

The ammeter shall be suitable for connection to 5 Amp. Secondary of Current Transformer or directly through shunt as shown on the drawings. The instruments shall have measuring range indicated on the drawings. A red mark shall be provided at the working voltage on the scale of all voltmeters.

#### **8.4 Selector Switches**

Ammeter and voltmeter selector switches shall be complete with front plate, grip handle, R-Y-B and OFF position for ammeter and RY-YB-BR-RN and OFF positions for voltmeters.

The selector switches for controls shall be rotary cam type and shall be provided complete with knob and front plate, showing all positions as required.

#### **8.5 Push Buttons**

The push buttons shall be momentary make / break contact type (normally open / normally close) and suitable for flush mounting. The push button for ON and OFF switching shall be red and green respectively.

#### **8.6 HRC Fuses**

HRC Fuses shall be provided complete with fuse bases, fuse, etc. The fuses shall have a fusing factor as specified for class QI in accordance with BS 88.

#### **8.7 Pilot Lamps**

Switchboard shall be provided with phase indicating pilot lamps. The lamps shall be rated for 250 volts supply and suitable for flush mounting. The front of the lamps shall have colored rosettes for identification of phases.

#### **8.8 Line up Terminals**

Line up terminals wherever provided for Control or Power circuits shall be suitable for voltage and size of conductors as indicated on drawings. The Line up terminals for controls 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.

#### **8.9 Secondary Wiring**

All wiring shall be copper conductor, thermoplastic insulated, at least 1.5 sq. mm flexible, neatly arranged and clipped in groups.

Each conductor and its termination are to be identified and marked with numbered ferrules. All live terminals are to be shrouded.

Secondary wiring for Current Transformers shall be carried out with not

less than 2.5 sq. mm. Terminals shall be specially marked to avoid opening of the circuit by accident.

## 9. INSTALLATION

The LV Switchboard shall be installed at location shown on the drawing. The Contractor shall ensure coordination with civil works for providing any openings, holes, etc. to avoid any breakage to completed works. In case the provisions in civil works for the installation of electrical equipment are not made or made incorrect the same shall be rectified by the Contractor at his own cost and to the satisfaction of the Engineer. The Contractor shall provide foundation bolts and grout them in cement concrete floor using non-shrinkable material with the approval of Engineer.

All installation material for physically erecting the Switchboard, such as bolts, nuts, washers, supporting steel, etc., shall be provided and installed by the Contractor. The Switchboard shall be installed upright and in level and shall be firmly and rigidly bolted to the floor and concrete supports.

The switchboard shall be completely erected as per manufacturer's instructions and as approved by the Engineer. Loose parts dispatched by the manufacturer shall be installed and connected as per assembly drawing provided by the manufacturer. Any safety locking provided by the manufacturer for safe transportation shall be released only after the switchboard is erected in position.

The incoming and outgoing cables shall be connected as recommended by cable manufacturer. The cable armour shall be connected effectively to ground.

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 tests to be carried out shall be tested before energizing as per instructions contained in the article "Testing" of General Specifications of Electrical Works, section E-1 of these specifications.

### SECTION - E - 3 LOW VOLTAGE CABLES AND WIRES

#### 1. SCOPE OF WORK

The work under this scope consists of supplying, installation, testing, connecting and commissioning of all material and services of low voltage cables and wires and the accessories as specified herein or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

The LV cables and wires with accessories shall also comply with the General Specifications for Electrical Works, Section E- 1 and with other relevant provisions of the Tender document.

#### 2. GENERAL

All multicore and single core wires for light circuits, socket outlets and circuits operating upto 250 volts shall be 300 / 500 volts grade. All single core sheathed cables shall be of minimum 450 / 750 volt grade. Power cables for main feeders, main to submain feeders, power equipment, etc., armoured or unarmoured shall be of 600 / 1000 volts grade. Armouring of cables shall be done with appropriate size galvanized steel wire as per codes.

The conductors shall be stranded or solid, high conductivity, soft annealed copper. Conductor of single core cables shall be circular, whereas of multicore cables may be circular or shaped according to standard practices and codes. The PVC insulation shall be extruded with a PVC compound having good flexibility, resistance to aging and ability to withstand the ambient temperatures as given in General Specifications for Electrical Works, Section E-1 of these specifications. Cable should be capable of running 125% of full load current without any damage.

All power cabling used for external power distribution shall be armoured type.

#### 3. STANDARDS

LV Cables and Wires shall comply with Section – E -1, Clause 3.

Particular reference shall be made to :

BS 6004 / 6346	PVC insulated cables for lighting and power.
BS 6746	PVC insulation for electrical cables.
BS 6360	Copper conductors
BS 6500	Insulated flexible cords.

Any other standard referred to in above standards or these specifications.

#### 4. MATERIAL

##### 4.1 General

The power, lighting and control cables shall be furnished and installed in accordance with the routes and requirements shown on the drawings.

All cables shall have phase identification colours on insulation of each

core. The colour code for three phase circuits shall be red, yellow and blue for phase conductors and black for neutral conductor. Where insulated earth conductor is installed, it shall have green colour insulation.

Single phase circuits shall have insulation of red colour for phase / line, black colour for neutral and green colour for earth conductor.

All DC circuits shall have insulation of red colour for positive, black colour for negative and green for earth conductor.

The ends of each length of multicore armoured or unarmoured cables shall be properly marked for clock-wise and anti clock-wise sequence of core colours.

#### **4.2 Cables for Conduit Wiring**

All cables / wiring in concealed or surface mounted PVC or steel conduits shall be single core PVC insulated of specified grade and size, unless specifically shown on the drawings or given in BOQ.

#### **4.3 Cables on Surface / Concrete Trenches**

Cables for distribution system to be installed on surface, in cable ducts, in concrete trenches or on trays shall be single or multicore PVC insulated and PVC sheathed of specified voltage grade and size, unless specifically shown on the drawings or given in BOQ.

#### **4.4 Underground Installation**

Cables for laying directly underground shall be PVC insulated, PVC sheathed and armoured with galvanized steel wire. Cables fully installed in underground ducts / pipes and mechanically protected from end to end shall be PVC insulated and PVC sheathed unless specifically shown on the drawings or given in BOQ. The installation work of underground cabling shall be done completely as per the prevailing standards or as per the drawings.

#### **4.5 Cable Accessories**

All cable accessories shall be provided for the complete cabling and wiring system without any additional cost unless specifically mentioned in BOQ. These shall include but not limited to the items such as saddles, clamps, fixing channels, connectors, cable joints (where necessary and approved by the Engineer), clips, lugs, tapes, solder, identification tags, bushes, glands, etc.

## **5. INSTALLATION**

### **5.1 General**

When the laying is effectuated by others, the contractor shall test the cable characteristics insulation and continuity, at all phases of these and communicate them in a report to the Engineer, as per recommendations of the standards according to which the cable is manufactured.

The cables shall be spaced by categories along their entire length as

well as upon penetration into buildings and in their interiors, according to their following rated voltages:

- 30 cm at least between a cable carrying 1 KV - 30KV and other cables.
- 20 cm at least between a cable carrying voltages between 50V
- 500V, and any power or control 10 cm at least between a cable carrying voltages lower than 50V and telephone or these possible being grouped.

All installation material, labour, tools and accessories for cable installation shall be furnished by the Contractor. The cable and accessories shall be installed as described in accordance with these specifications, drawings and manufacturer's instructions.

## **5.2 Conduit Wiring**

The wiring through conduit shall be started only after the conduit system is completely installed and all outlet boxes, junction boxes, etc., are fixed in position. The filling rate inside the conduits shall not exceed 50 %. Cables directly embedded in the masonry are not accepted.

The wires shall be pulled in conduit with care, preferably without the use of any lubricant. Where necessary and if approved by the Engineer, the cable manufacturer's recommended lubricant may be used. Where several wires are to be installed in the same conduit, they shall be pulled together along with the earth conductor. All wires of same circuit shall be run in one conduit.

The wires shall not be bent to a radius less than 10 times the overall diameter of the wire, or more if otherwise recommended by the manufacturer.

The wiring shall be continuous between terminations and looping-in system shall be followed throughout. Any joint in wires shall not be allowed. The use of connectors shall only be allowed at locations where looping-in is rendered difficult. The consent of the Engineer shall be required for using connectors. The connector shall be of suitable rating having porcelain body with sunk-in screw terminals. The connector shall be wrapped with PVC insulation tape after its installation. A minimum of 150 mm extra length of cable / wire shall be provided at each termination to facilitate repairs in future.

## **5.3 Cables on Surface / Trenches**

All cables for installation on surface of wall, column, ceiling, trenches, etc., shall be fixed to the surface by means of galvanized steel clips, secured to a steel channel using suitable stud plate, nuts and washers.

The erection of cables and position of support shall be agreed by the Engineer on site, having taken into consideration the accessibility of all such routes. These shall be so arranged that cable crossing one another be minimized if cannot be avoided.

Cables shall be fixed throughout their length by means of approved saddles, clips, etc., at every 600 mm vertically and 900 mm horizontally.

Cables and equipment fixed to a building fabric, i.e., brickwork, concrete, etc., shall be fixed by means of appropriate fixing devices, i.e., Raw bolts, Hilti fixing devices, etc., or alternatively by means of suitable fixing devices cast at site, e.g., concrete inserts.

Contractor shall be responsible for all drilling of steel work, brick work and masonry where necessary for fixing clamps and brackets for supports.

Cables shall not be pulled into conduit until the conduit system has been completed, cleared and free from obstruction and sharp edges.

It shall be ensured that conduit system is clear before cable is drawn in. cables shall be put into conduits in such a manner that there will be no cuts or abrasions in the cable insulation, protective braid and jackets. There shall be no link in the conductors.

Distance of saddles shall be used for installation of cables in defined condition of the surface of wall etc.

Grease or other injurious lubricants shall not be used in pulling cables. The use of talc or non injurious lubricants is permissible, if desirable.

The number of wires installed in any conduit shall be such that the resulting space factor does not exceed 50 %. Spliced wires shall not be pulled through conduits.

All conduit wiring shall be carried out in the loop - in principle from outlet box to outlet box and in no circumstances shall joints be used except in fixed base connection blocks housed in outlet boxes.

The vertical clearance between two adjacent cables at any point is 50 mm minimum. Common mounting, channels are to be furnished for cable along the same route. The Contractor can offer alternate cable fixing arrangement, which shall be approved by the Engineer before commencement of installation.

The wall crossings where the outdoor cables penetrate in the building shall be carefully obstructed by means of polyurethane foam. The Contractor shall be fully responsible for the perfect tightness of these cable penetrations.

#### **5.4 Underground Cables**

The Contractor shall plan and take special care to prevent any damage to existing under ground facilities such as under ground piping, cables, foundations, etc. The Contractor shall notify the Engineer of any obstruction encountered and shall provide protective support or removal of such obstructions as instructed by the Engineer. Excavation adjacent to existing facilities, such as foundations manholes, ducts, under ground pipelines and paving shall be braced and / or shored properly to protect those facilities during excavation and construction.

Sufficient slack shall be left in cables for this purpose that cut lengths of cables shall allow about 3% more in the measured lengths between



terminations.

The RCC chamber of appropriate size shall be provided at every joint of cables as per standards and actual site requirements. The details of RCC chamber shall be provided by contractor prior to commissioning of works.

Cables, whether installed under ground or in concrete trenches, shall not be bent to a radius less than 10 times the diameter of the cable or as recommended by the cable manufacturer, whichever is higher.

All cables shall be marked at least at each end, switch gear and equipment termination, where cable enter or leave under ground cable trenches or channels, where cable rises from one level to another, at 30M intervals with predetermined identification numbers, by means of proprietary non-deteriorating type, PVC, heat shrinkable, strap-on type or equivalent, for the identification of cable and circuit. These shall be indelibly marked with cable number and securely fixed to the cable. Where conductors are left to be terminated by another party or left to be connected later, they shall be identified. The earth continuity conductor shall be laid in the trench with the cables.

Cables entering the buildings shall also be laid in protective pipes. The protective pipe ends, after installation of cables, shall be plugged water tight by means of polyurethane foam / bituminized Hessian or equivalent method as approved by the Engineer.

### **5.5 Cable Termination and Joints**

Cables shall be terminated in a safe, neat and approved manner at the associated equipment, included that erected by others.

Compression type connectors (lugs) shall be of the correct size and approved type for the conductors concerned. Compression tools shall be supplied for specific use and shall be maintained in good order. After compression the conductor and terminal shall form a solid mass ensuring good conducting properties and mechanical strength. The compression jointing system used throughout the installation must be approved by the Owner or his representative before use.

The Contractor shall be responsible for all drilling and if necessary, tapping entries where these have not been provided by others.

When preparing cables prior to fitting glands, the gland manufacturer's instructions for cable preparation shall be observed. In all cases where armored cables are used, care shall be taken to ensure that the lay of the armor is maintained after the gland is completely fitted.

Termination and joints shall be suitably insulated for the voltage of the circuits in which they are used.

Every compression joint shall be of a type, which has been the subject of a test certificate as described in BS 4579.

The RCC chamber of appropriate size shall be provided at every joint of cables as per standards and actual site requirements. The details of RCC chamber shall be provided by contractor prior to commissioning

of works. Extra loops shall be left of cables at the end of every termination.

Cable ends, which are not terminated immediately after cutting, shall be sealed effectively to prevent ingress of moisture and shall be protected from damage until termination.

For all cables above 6 sq. mm in section, if a substantial mechanical clamp is not provided a compression type lug or socket shall be provided. At all equipment, cable shall be installed and terminated so that no strain is imposed on the cable or gland and due allowance made to counter the effect of vibration. At all termination an ample length of 'tail' shall be left.

Where joints in cable conductors and bare conductors are required, they shall be mechanically and electrically sound and they shall be accessible for inspection. Joints in non-flexible cables shall be made either by soldering or by means of mechanical clamps or compression type socket, which shall securely retain all the wires of the conductors.

Any joint in flexible cable shall be effected by means of cable coupler. Cable couplers and connectors shall be mechanically and electrically sound and shrouded in metal, which can be earthed. Where the apparatus to be connected require earthing every cable coupler shall have adequate provision for maintaining earth continuity.

Cables of AC circuits, installed in PVC or steel conduit shall always be so bunched that the cables of all phases and the neutral conductor (if any) are contained in the same circuit. The outdoor apparatus shall normally be connected by means of cables with conduit termination down to about 30 cm below ground level or concrete foundation. The conduit shall be firmly secured down to their penetration into the trench or channel.

## SECTION - E - 4 CONDUITS AND PIPES

### 1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete Conduits and Pipes as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

The Conduit and Pipes with accessories shall also comply with the General Specifications for Electrical Works, Section E- 1 and with other relevant provisions of the Tender document.

### 2. GENERAL

The extent of works shown on the drawing does not indicate the exact position of conduit and pipes. The Contractor shall ensure exact location and route of conduit and pipes in coordination with other services drawings, as per site requirements and as directed by the Engineer.

The quality and material for the accessories of conduits and pipes such as sockets, elbows, bushings, bends, inspection / pull boxes, round boxes, etc., necessary for the completion shall be similar to that of conduit or pipes. All the accessories shall be supplied by the Contractor without any extra cost and deemed to have been included in the price of conduits / pipes.

### 3. STANDARDS

Pipes and Conduits shall comply with Section - E-1, Clause 3.

Particular reference shall be made to:

BS 31	Steel Conduit and accessories
BS 1378	Galvanized Iron Pipes and accessories.
BS 3595	PVC Pipes and accessories.
BS 4607	PVC Conduits and accessories.

Any other standard referred to in above standards or these specifications.

### 4. MATERIAL

#### 4.1 PVC Conduits, Pipes and Accessories

The PVC conduits and accessories for lighting and power circuits shall be furnished by the Contractor as shown in the drawings or given in BOQ. The PVC bends shall have enlarged ends to receive conduit without any reduction in the internal diameter at joint. Manufactured smooth bends shall be used where conduit changes direction. Bending of conduits by heating or otherwise will be allowed in special situations only, for which the consent of the Engineer shall be required. The use of sharp 90 degree bends and tees will not be allowed for concealed wiring.

The round PVC junction boxes for ceiling light or fan points shall have minimum dimensions of 64 mm diameter and 64 mm depth. The junction boxes for wall light points shall have minimum dimensions of 57 mm diameter and 40 mm depth. Round junction boxes shall be

provided with one piece bakelite cover plate fixed to the box by means of galvanized screws.

The PVC pipe shall be rigid and shall be minimum B-Class (working pressure - 12 Kg / cm), unless otherwise stated on Drawings or Bill of Quantities. Where pipe changes direction, manufactured smooth bends shall be used. For jointing of pipe, all precautions and procedures recommended by manufacturer shall be followed.

#### **4.2 Steel Conduit and Accessories**

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

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

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

#### **4.3 Galvanized Iron Pipes and Accessories**

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

#### **4.4 Inspection Boxes / Pull Boxes**

The rectangular inspection boxes or pull boxes shall be of 16 SWG heavy gauge, sheet steel having nipples welded to box at entry holes to receive PVC conduit with force fit. The box shall be painted inside and outside with black enamel paint over a base coat of red oxide primer paint. The minimum length of inspection box shall not be less than six times the cable manufacturer's recommended bending radius of the cable. All concealed type pull boxes shall have a white plastic sheet of appropriate size fixed to the box by means of galvanized screws.

#### **4.5 Adaptable Boxes**

Adaptable boxes shall be made of 16 SWG sheet steel box, painted and finished to the same quality as the light Distribution Board. The boxes shall be 50 mm in depth for conduits up to 25 mm diameter, 63 mm in depth for conduits up to 40 mm diameter and 87 mm in depth

for conduits up to 50 mm in diameter. For conduits more than 50 mm in diameter, the minimum depth shall be two times the diameter.

#### **4.6 Conduit / Pipe Accessories**

Bushes, plugs, glands, etc., shall be of brass and all male bushes shall be of long thread pattern. Covers for boxes shall be screw fixed and finished as the boxes. Gaskets shall be fitted only when finish is galvanized unless otherwise specified.

#### **4.7 Cable Trunking**

Where required, wiring shall be run in hot-dipped galvanized (after fabrication) sheet steel cable trunking of the specified gauge complete with all fittings and accessories, manufactured and installed in accordance with BS 4678/NEMA. The trunking shall be constructed with return flanges. Trunking covers shall be secured by anchored turn-buttons and locking bars and minimum length of individual sections shall be 2.44-m. The trunking shall be suspended/supported from the structure at maximum 2-m intervals with straps and hangers fabricated from minimum 6-mm dia HDGI bars, or supported by angle-iron brackets.

Conduit drips from the trunking shall also be supported with hangers. Factory made connectors shall be used at joints.

Junctions (tee and 4-way) in multi-compartment trunking shall be double depth to avoid reduction in cabling space. Cable in vertical runs shall be supported by pin racks, prongs or bridging pieces. Fire barriers shall be provided at each floor level. Allowance for expansion shall be incorporated.

Bonding links shall be provided at each joint and secured by screws, nuts and shockproof washers. The bonding links shall make contact with the metal of the trunking or fitting, and continuity shall not depend on contact through the screws, nor on removal on site paint finish from ferrous metal.

## **5. INSTALLATION**

### **5.1 PVC Conduits - Concealed**

The conduit shall be installed concealed in roof, wall, column, etc.

At all joints and bends, PVC jointing solution as manufactured by Pakistan PVC Limited or approved equivalent must be used to strengthen and to seal the joint.

Manufactured smooth bends shall be used. Bending of conduits by heating or otherwise will be allowed in special situations only, for which the consent of the Engineer shall be required. The use of 90 degree bends and tees will not be allowed.

The conduit shall have a minimum of 38 mm cover of concrete. In the reinforced cement concrete (RCC) work, the conduit shall be laid before pouring of concrete. Under no circumstances shall chases be made in the RCC structure for concealing conduit and accessories,

after pouring of concrete. The concrete shall be supported on top of bottom reinforcement of slab and shall be firmly secured by tying to the reinforcing steel in order to avoid being disturbed during pouring of concrete.

All outlet boxes to be firmly supported and installed such that they finish flush with the soffit of slab of beam.

Where conduits have to be concealed in cement concrete (CC) work after concreting, or in block masonry, chases shall be made with appropriate tools and shall not be made deeper than required. The conduit shall than be fixed firmly in the recess and covered with cement concrete mixture to have to at least 32 mm cover before plastering. The work of curing in the cement concrete work or block masonry work shall be coordinated with the civil work. The Contractor shall obtain approval from Engineer for the route, to suit the site conditions before starting chasing and cutting.

The termination of conduits at or near the Switchboard / Distribution Board is shown diagrammatically on the drawing. The exact final locations of the termination shall be coordinated with the Switchboard / Distribution Board to be installed. Any extension of conduit near the Switchboard / Distribution Board to suit the site condition shall be made without any extra cost. Conduit ends pointing upwards or downwards shall be properly plugged in order to prevent the entry of foreign materials. All openings through which concrete may leak shall be carefully plugged and boxes shall be suitably protected against filling with concrete. At all termination of concrete, soft bushes shall be fixed to prevent sharp edges of conduit ends from cutting or damaging the wires or cables to be pulled through them.

The entire conduit system shall be installed and tested before wiring is carried out. Any obstruction found shall be cleared by use of cutting mandrel or other approved device and the conduit shall be cleaned out before the installation of cable.

Pull boxes / Adaptable boxes shall be provided in conduit runs wherever required to facilitate pulling operation. The drawings are diagrammatic and do not indicate the position and spacing of pull boxes or adaptable boxes. However, these shall meet the following requirements:

- Pull boxes.  
For straight runs the spacing shall not be more than 30 meters.  
For runs with one 90 degree bend, the spacing shall not be more than 15 meters.
- Adaptable boxes.  
For conduits up to 25 mm diameter, the boxes shall be 50 mm in depth.  
For conduits up to 40 mm diameter, the boxes shall be 63 mm in depth.  
For conduits up to 50 mm diameter, the boxes shall be 87 mm in depth.

Wherever the conduit lengths cross the expansion joint either along the column or slab, suitable arrangement shall be provided so that when the conduit lengths in the expansion joint are stressed, the conduit neither develops any cracks nor breaks down.

Bending, off setting and similar operations shall be performed through the help of proper bending tool to give a perfect bend of required angle without Desha ping of conduit to the least.

## 5.2 Steel and G.I Conduit

The minimum size of conduit shall be 20 mm.

The use of solid or inspection elbows, bends or tees will not be permitted and 120 degree bends shall be limited to one between any two drawn-in boxes.

Conduit coupling joint shall not be used where conduit enter spout entry boxes. Conduit running, joints shall not be used where conduit enter conduit boxes or spout entry boxes.

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

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

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

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

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

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

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

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

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

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

### 5.3 Fixing of Conduits and Fittings

Conduits in process units and on steel work with "U" bolt type fixings.

Conduits in buildings shall be fixed with galvanized distance saddles. Where a number of conduits follow a single route they may be fixed to mild steel brackets.

Conduits shall be supported on both vertical and horizontal runs as follows:

- Conduits size 20 mm and 25 mm maximum spacing of fixing 1000 mm.
- Conduit sizes larger than 25 mm spacing of fixing 1500 mm.

All conduit boxes that support fittings shall be securely fixed. All conduits shall be fixed 150 mm before and after every right angle or off set. All conduit fittings and equipment shall be fixed true and line able.

All conduit bends shall be made with an approved conduit bending machine or hickory. The radius of curvature of the inner edge of any bend shall not be less than the following table:

Conduit size	Radius
20 mm (3/4")	Not less than 130 mm.
25 mm ( 1" )	Not less than 150 mm.
32 mm ( 1-1/4")	Not less than 200 mm.
38 mm ( 1-1/2")	Not less than 255 mm.
50 mm (2")	Not less than 305 mm.
75 mm ( 2-1/2")	Not less than 380 mm.
82 mm (3")	Not less than 460 mm.
100 mm (4")	Not less than 610 mm.
150 mm (6")	Not less than 750 mm.

Under ground conduit stud-up or kick pipe through concrete envelope shall be extended a minimum of 150 mm above grade and adequately braced to prevent shifting during concrete pouring work. The concrete envelope shall extend at least 76 mm above grade.

Under floor conduit installation shall be at a minimum depth of 120 mm from finished floor level. The G.I. pipes / conduits shall be installed at a minimum depth of 1000 mm measured from the top of size to the finished road level.

### 5.4 Location of Conduits and Fittings

Before conduits are installed, confirmation shall be obtained that the conduit may be installed in that position.

Particular attention shall be given to the location of conduits to prevent the infringement of headroom and access ways.

Conduits shall be located to avoid obstructions, furnaces, hot lines and other places of high temperature.

Conduit shall not be located than 150 mm (6") where it runs parallel to



or crosses hot surfaces. Under ground conduit runs shall be kept to minimum in both number and length. Conduits shall not be recessed in fair brick work.

Draw boxes shall be so positioned to enable the cables to be drawn in easily. The boxes shall not be located in the comers or other such locations and shall be positioned to avoid tight bends, bending and cable kinks.

Conduits shall not generally be installed having a greater length 12,000 mm (40 feet ) between draw-in boxes.

Conduit entries shall wherever possible be located in the bottom of boxes and equipment etc.

## SECTION - E - 5 WIRING ACCESSORIES

### 1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete switches, switch sockets, etc., and miscellaneous items as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

The wiring accessories shall also comply with the General Specifications for Electrical Works, Section – E - I and with other relevant provisions of the Tender document.

### 2. GENERAL

The locations of the wiring accessories such as sockets, switches etc. are tentatively shown on the drawings. The Contractor shall ensure exact positions and locations of wiring accessories in coordination with other services drawings, as per site requirements and as directed by the Engineer. The Contractor shall be responsible for proper functioning of wiring accessories after installation and Commissioning.

### 3. STANDARDS

Wiring accessories and miscellaneous items shall comply with Section - E-1, Clause 3.

Particular reference shall be made to:

- BS 67 Ceiling roses.
- BS 1363:1984 13A fused plugs and unswitched socket outlets
- BS 116 Two and three terminal ceiling roses.
- BS 2135 Capacitors for radio interference suppression
- BS 3676 Switch for domestic and similar purposes.
- BS 4934 Safety requirements for electric fans and regulators.
- BS 5060 Performance of circulating fans and their regulators.

Any other standard referred to in above standards or these specifications.

### 4. MATERIAL

#### 4.1 Switches

Switches for controlling light and fan points shall be single pole, rated for 10 Amp, 250 VAC. The body of switches shall be made of poly carbonate / urea with white face plate suitable for flush mounting on sheet steel outlet box. The switches shall be gang type having silver tipped contacts and operate with snap action.

For locations where switches and fan speed regulators are installed together, single switches shall be grouped and fixed on 3 mm thick plastic sheet screwed to a sheet steel box of appropriate dimensions. The fixing of plates on outlet boxes shall be means of flat head counter sunk galvanized screws with the head of the screw finish flush with the surface of the plate. Except for switches controlling light points, all single switches for fans, sockets, etc., shall have identification symbols on the

operating levers.

Two way switches shall be used to control lights from two different locations as shown on the drawings.

#### **4.2 Switch Socket Outlets**

Switch socket units shall be of flat pin type and conform to BS 1363, 13A for fused plugs and socket outlets. 2 and 3 Pin rated for 15 Amps. or 2 Pin rated for 10 Amps. Supply as specified in the bill of quantities.

3 Pin 15 Amps. Sockets shall be moulded type having white plastic face plate, suitable for mounting on a sheet steel box of appropriate dimensions. Switch sockets shall have shrouded live contacts such that the earth pin is engaged to socket earth before making with the live contacts. Where specified, the switch socket unit shall have spring loaded dust tight cover for mechanical protection.

#### **4.3 Sheet Steel Boxes**

The outlet boxes for installation of switches, fan speed regulators and socket outlets shall be 16 SWG sheet steel having appropriate dimensions. The boxes shall have suitable knockouts or welded nipples for receiving the conduits. An earth terminal shall be provided for connecting at least three earth wires of 4 sq. mm. The outlet boxes shall be given two coats of anti-rust red oxide and one coat of enamel before installation. The boxes shall be suitable for mounting flush with the surface of wall or on the surface of wall as may be required. The boxes shall not be less than 75 mm x 75 mm (3" x 3"). All boxes shall be water tight where installed in the vicinity of liquids.

#### **4.4 Ceiling Rose**

The ceiling rose shall be suitable for 5 Amps. 250V AC. It shall have white plastic moulded base plate, copper or brass terminals for connecting at least two wires of 2.5 sq. mm size. The ceiling rose shall have a cover with cable inlet hole for multicore PVC insulated and PVC sheathed cable.

#### **4.5 Fans**

##### **4.5.1 Bracket Type**

The bracket type fans shall be suitable for mounting on the wall and suitable for operation semi-horizontally. These shall operate satisfactorily on 250 volts, single phase, 50 Hz, A.C. supply with + 10 % tolerance.

The sweep of the fan shall be as given in BOQ/drawings.

##### **4.5.2 Exhaust Fan**

The exhaust fans shall be three blade types, mounted on the steel/plastic structure of its own, which will be fixed to the structure by means of suitable grouted foundation bolts. The fan shall be suitable for operation on 250 VAC with + 10 % tolerance.

The sweep of the fan shall be as given in Schedule of Quantities/drawings. Fans shall be direct driven and supplied

complete with electric motor, back draft dampers and anti-vermin screen. The bearings shall be ball, roller or sleeve type of permanently lubricated and sealed type.

Wheels shall be heavily and rigidly constructed and accurately balanced both statically and dynamically and free from objectionable vibration or noises.

The fans shall comply with BS 380 as far as constructional requirements, range of fan speed, speed regulator starting, radio interference silent operation and temperature rise is concerned. For testing BS 848 as amended 1 960 shall be complied with.

#### **4.5.3 Ceiling Fan**

The ceiling fans shall be consist of three blade types with 56" and suitable for operation on 250 VAC with +10% tolerance. The Fan shall be mounted directly on ceiling; the lowest point of the fan blade is approximately 300mm (1 foot) below the ceiling. Make sure that the chosen location of the fan will not allow the rotating fan blades to come into contact with any object.

Ensure ceiling joists are sound and of adequate size to support a 35Kg (77lb) load. To reduce the risk of fire, electrical shock or personal injury, ensure that the fan mounting bracket is supported directly from the building structure. Do not mount to an outlet box. The mounting bracket must be firmly screwed to a load bearing structure e.g. a concrete ceiling, steel structure or timber frame. If a timber frame is to be added it must b securely nailed or screwed between two beams.

## **SECTION - E – 6 LIGHTING FIXTURES**

### **1.0 SCOPE OF WORK**

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete light fixtures as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and positions of light fixtures.

### **2.0 GENERAL**

The description of light fixtures in given Bill of Quantities, and stated on the drawings, and relevant material are described in this section. The determination of quality is based on certified photo-metric data covering the coefficient of utilization, light distribution curves, construction material, shape, finish, operation, etc.

The Contractor shall submit two samples of each and every light fixture specified and obtain approval of the Owner before purchasing. The quality and finishes of local make light fixtures (if mentioned in BOQ) shall be same as that of standard manufacturer. The accessories such as ballast, lamp / starter holders, starters, lamps, igniters, etc., for all type of light fixtures shall be of Philips make.

All fixtures shall be finished in standard color schemes as mentioned in the manufacturer's catalogue for respective fixtures, unless specifically stated in the Specifications, Drawings or Bill of Quantities or directed by the Engineer.

### **3.0 STANDARDS**

Lighting fixtures shall comply with Section E-1, Clause 3.

Particular reference shall be made to:

- IEC 60598 Luminaries.
- IEC 62031 LED modules for general lighting-Safety requirements.
- IEC 62384 DC or AC supplied electronic control gear for LED modules performance requirements.
- BSEN 1838 Emergency Lighting

Any other standard referred to in above standards or these specifications.

### **4.0 LED Light Fixtures**

The light fixture shall be as stated on drawings and bill of quantities. The light fixture shall be finished in standard colors unless otherwise stated on drawings or directed by Engineer. All LED light fixtures shall be of international standard and quality. The type of fixtures with manufacturer catalogue reference is given on the fixture schedule and in Bill of Quantities. Equivalent fixture may be acceptable provided that the Contractor submits for review all necessary data indicating photo-metric curves to show that the fixture proposed are of the same type, construction and quality.

The lamps for light fixtures shall be Light Emitting Diodes with driver and shall be supplied and installed according to the wattage as indicated on drawings.

Weather proof light fixture shall comprise of cast aluminum body and gasketed clear glass cover secured to the body by means of galvanized nuts / screws to give a weather proof and water tight fit. The gasket shall be weather resistance type.

The LED light fixtures shall be supplied complete with driver and all accessories as per light fixture schedule and shall be installed in accordance with manufacturer's recommendations and sound engineering practice.

## **5.0 INSTALLATION**

### **5.1 General**

The mounting heights of light fixtures are indicated on the drawings, and position of fixtures according to the mentioned scale.

The Contractor must ensure that the light fixtures are installed uniformly with respect to the dimensions of the area. Any modifications due to site conditions may be made with the approval of Engineer. All fixtures shall be carefully aligned before fixing in position. All fixing accessories such as ceiling rose, flexible cord, lamp holder, suspension rod; pipe or chain with suitable canopy, etc., shall be provided and installed.

The wiring between terminal box and the fixture shall be carried out with 3 core 0.75 sq. mm and 1 sq. mm copper conductor, PVC / PVC cable respectively for circuits protected by 10 amps and 15 / 20 amps MCBs. The wiring inside light fixture body shall be done with heat resistant cables or PVC insulated cable in heat resistant sleeves as approved by the Engineer.

Glasses, shades, reflectors, diffuses, etc., must be in a clear condition after installation.

All light fixtures shall be earthed by an earth wire connected to the earth terminal in the fitting.

### **5.2 LED Light Fixtures**

The LED light fixture shall be installed on the surface of ceiling or wall by means of nylon plugs and galvanized steel screws, such that their back finish flush with the surface for exposed conduits and flush with outlet box for concealed conduit system. Wherever convenient, screws for fixing light fixtures shall be screwed into the holes of the outlet box. The light on false ceiling shall be installed in accordance with manufacturer's recommendations and in coordination with ceiling installation.

### **5.3 Outdoor Lighting**

For illumination around buildings during dark hours, light fittings in various arrangements shall be provided in accordance with these

specifications. The items not shown on drawings or called for, but which are necessary for a complete working system as required, these shall also be provided and deemed to have been considered as such. The Contractor shall essentially use the standard products of a manufacturer, regularly engaged in the manufacture of the product and shall meet the requirement of the specifications.

**SECTION – E - 7**  
**VOICE & DATA COMMUNICATION CABLING SYSTEM**  
**(Passive Equipment's only)**

**1. RELATED DOCUMENTS**

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

**2. SYSTEM DESCRIPTION**

The proposed cabling system for the UTP and Fiber network cabling and Fiber Links shall be an open system (Passive Only) and application and vendor independent and shall be warranted by an International Vendor for a minimum of 25 years. The contractor Installers (labor) and engineers must be trained and certified by this vendor to design and install cabling system.

**3. DATA CABLING SYSTEM**

Data racks shall be located in IT rooms as per drawing. Cat 6 cable for Voice and Data shall be used for interconnecting outlets with patch panels. The cable run from the IDF to the associated Data outlet is limited to 90m.

Wiring system used shall be star topology i.e. each data outlet is connected directly to the IDF (Intermediate Distribution Frame) IN Cat-6 RJ45 24 port patch panel.

Vertical runs between each IDF shall be of 8 core multimode OM4 fiber optic cable and 25 pair cat 5e cable.

Horizontal runs from a patch panel to the data outlets using 4 Pair UTP twisted pair cables Cat 6.

Data Processing system shall be supplied installed and tested complete in place including but not in a way of limitation, cables, socket outlets, adapters, connectors, patch panels, patch cords, wire management, floor distributors (racks/cabinets).

The Data Cabling System shall be designed using standard, proven equipment and materials with the latest Technology version or model. If there is any problem during warranty period related to the shortage of Materials, the Contractor shall supply them with no extra cost to the Project.

The design shall fully comply with TIA/ EIA 568B & ISO 11801 in a full star topology configuration.

The network data cabling systems support at least 1000 Base-T (Gigabit) Ethernet or faster protocol.

The UTP (unshielded twisted pair) Category 6 cable's technical specifications shall be up to the highest industry standards and should have performance specifications better than 250 MHz and should exceed all proposed requirements for data, Gigabit applications.

The UTP Category 6 cable's technical specifications shall be up to the TIA/EIA-



568B.2-1 industry standards and should have performance specifications better than 250 MHz and ample margin compared to the Category 6 Standard for performance in factors such as NEXT.

For both voice and data cat 6 cable shall be used.

#### **4. SCOPE**

The contractor shall carefully examine all of the specifications to ensure that he is fully conversant therewith and has included for everything necessary therein, either expressly provided for or as would normally be expected to be provided for by a reputable contractor specializing in the type and nature of the Services described in the Contract.

The Contractor is advised that items or matters not specifically provided for, or partially described or otherwise missing from the specifications, but which are nevertheless necessary for the execution and completion of the Services, shall be deemed to have been included by the Contractor.

The Contractor shall ensure that all selected manufacturers of equipment and materials provide with appropriate warranties and guarantees for their products.

Authorized and certified installers registered with their respective Manufacturers shall execute the installation of the Cabling system.

The Contractor shall also be required to submit, in their bid, a list of personnel along with their CV, certifying that the installers it intends to employ on the services have the necessary training and experience.

The LAN cabling system shall meet the emerging TIA/EIA 568A/B and ISO 11801 For Voice cat6 is to be used, while for Data and WIFI access point CAT 6 is used. Category 6, Class E specifications and shall support Gigabit Ethernet, Sonet/asynchronous transfer mode (ATM) at rates (minimum of) 1 Gbits/seconds and analog broadband video in addition to existing and multimedia technologies.

The Contractor shall carry out all the necessary surveys, design and engineering so as to provide for the Services, a whole and complete system to ensure full compatibility of the Services with any of the existing facilities pertinent to Cabling System applications & operations.

The scope of the Services include the provision of all material, labour, supervision, construction, equipment, tools, temporary, test equipment, spares, consumable and all other things and services required to engineer, design, supply, install, test and commission the Cabling System.

It is the responsibility of the Contractor to make sure that the system works at the company environment.

The Vendor must provide a list of project Reference within the last three years.

The Vendor must have completed a project with a minimum of 1000 points or higher of Category 6.

#### **5. SUBMITTALS**

Product Data: Submit manufacturer's data on signal transmission media and components.

Shop Drawings: Submit layout drawings of computer cable distribution system and accessories.

Wiring Diagrams: Submit data transmission wiring diagrams for computer system, including rack and terminal connections.

#### **6. QUALITY ASSURANCE:**

Manufacturer's Qualifications: Firms regularly engaged in manufacture of signal transmission media and accessories of types required, whose products have been in satisfactory use in similar service for not less than 5 years.

Installer's Qualifications: Firms with at least 5 years of successful installation experience with projects utilizing systems and equipment similar to that required for this project.

Co-ordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of data system with other work.

Sequence installation of data system with other work to minimize possibility of damage and soiling during remainder of construction.

#### **7. COPPER & FIBRE OPTIC CABLE AND CONNECTORS**

Unshielded twisted-pair copper & fiber optic cables shall be approved & recommended by component manufacturer. This is to enable the component manufacturer to give the necessary product and application warranties for the system.

Provide unshielded twisted-pair copper cable, fiber optic cable and connectors, in sizes and types as recommended by the active equipment manufacturer for indicated applications. Mate and match connector materials to factory-installed equipment.

Computer cabling System Accessories: Provide computer accessories, including modular wall and floor jacks, junction boxes, connecting blocks and pre-wired boxes.

The selection and type of material required for the Services shall conform to the specifications given herein and items or matters not specified herein shall conform to ISO/IEC 11801, EN 50173 and TIA / EIA 568B Category 6 Standards as applicable. The Contractor shall also ensure that the materials utilized to complete the Cabling System installation are capable of supporting the minimum expected performance requirements for emerging applications such as ATM services (1.2 Gbps), including 10 Gbps Ethernet. The complete system shall guarantee a minimum of 250 MHz & 100 MHz bandwidth performance and the products shall be from an internationally reputable manufacturer. The selection of materials shall be subject to approval by The Company.

The cable shall be composed of 23 or 24 AWG bare, solid-copper conductors. The insulated conductors shall be twisted into individual pairs and four such

pairs twisted together.

The cables shall be fully colour coded as provided hereunder, colour contrast being such that each pair in the cable is easily distinguishable from every other pair.

Conductor Identification	Coloured Code	Abbreviation
Pair 1	White – Blue Blue – (White)	WT – BL BL
Pair 2	White – Orange Orange – (White)	WT – OR OR
Pair 3	White – Green Green – (White)	WT – GN GN
Pair 4	White – Brown Brown – (White)	WT – BR BR

## 8. SPECIFICATIONS OF CABLES:

### For Voice UTP Cable

Cable Type	Category 6 UTP
Conductor Size(mm)	23 or 24 AWG
Number of Pairs	4
Nominal Outer Diameter (mm)	6.0
Impedance(Ohm)	100+/-15
Velocity of propagation (% speed of light)	69
Frequency (MHz)	250
Max. Atténuation @ 250 MHz (dB)	32.1
Worst case NEXT @ 250 MHz (dB)	38.3

### For Data UTP Cable

Cable Type	Category 6
Conductor Size(mm)	23 or 24 AWG
Number of Pairs	4
Nominal Outer Diameter (mm)	6.0
Impedance(Ohm)	100+/-15
Velocity of propagation (% speed of light)	69
Frequency (MHz)	250
Max. Atténuation @ 500 MHz (dB)	32.1
Worst case NEXT @ 500 MHz (dB)	38.3

## 9. HORIZONTAL CABLING DISTANCES

The maximum horizontal portion of a cabling system from work area information Cat 6 outlet to a mechanical termination at the patch-panel in the wiring closets must not be more than 90 meters. The cable run must be free of bridges, taps and splices.

Both ends of the cable shall be labeled for identification, i.e., at the patch panel and work area information outlet according to EIA/TIA 606 administration standards for the Data cabling of commercial buildings.

The horizontal cabling system shall be correctly designed and the work area

outlets in each shown or required location shall be correctly mapped to an appropriate wiring closet. The star topology shall be applicable to every individual unit of the transmission media.

## 10. FIBRE OPTIC & UTP CABLING

The backbone cabling interconnecting distribution frames to the data center shall be of multimode OM4 fiber cable 50/125 microns; 8-core cable with color-coded fibers. All fiber optic cables shall be laid in straight run without intermediate splices and all fibers shall be terminated at either end using suitable fiber cable patch panels mounted on the wiring closets.

OS2 9/125 microns single mode fiber optic cable shall be used to connect server room IDF rack to other premises IDFs

All fiber optic backbone links between the main cross connect and the Telecommunication rooms have a backup link using a different route from the main fiber optic link. Each of these links shall be 8-core fiber optic cable as described in this document.

The Contractor shall be responsible for the supply, installation, testing and commissioning of the complete fiber cable backbone interconnection/cross connection requirements of the "building/complex" LAN Cabling System.

The Contractor shall install suitable fiber optic pigtails/connectors needed to complete the entire fiber cable installation as per the manufacturer's recommendation and shall ensure that the backbone is capable to handle the traffic and provide error-free universal data transport for the foreseeable future.

All of the fibers in the backbone shall be terminated with LC type connectors at the time of the installation. The Contractor shall ensure proper testing of the fibers and make them available whenever they are needed. No fibers shall leave unterminated, all fibers must be terminated. A document with fiber cable test results for every fiber cable link shall be provided by the Contractor.

The Contractor shall observe the manufacturer's specifications for maximum tension and minimum bend radius for each fiber optic cable. The contractor shall provide a copy of the manufacturer's specifications to company prior to the commencement of the work.

Care must be taken when mechanical pulling devices are used, that maximum tension limits are not exceeded. Minimum bend radius specification shall not be violated when the cables are routed through walls or around corners. The contractor shall ensure that all installation personnel are aware of these limitations.

The Contractor shall follow an intelligent numbering system based upon the destination and channel number. The numbering system shall have a prefix 'F' to indicate it is a fiber optic cable, followed by the destination IDF, then a hyphen and the channel within the cable.

Logical labeling should be as per ANSI/TIA/EIA-606. Labels should be ring and printed type. No labels should be written by hand.

**11. OPTICAL FIBRE CABLE TECHNICAL SPECIFICATION**

Fiber optic cables within the premises shall use multimode, graded-index.

Fibers must comply with TIA/EIA 492 specifications and OM4 fiber specification as in ISO 11801 standard.

Fibers will have dual wavelength capability; transmitting at 850 and 1300nm ranges.

All fibers shall be colour coded to facilitate individual fiber identification. The coating shall be mechanically strippable.

Core	50 μm ± 3 μm
Core Non-Circularity:	<6%
Core/Cladding Concentricity Error:	<3.0 μm
Numerical Aperture:	0.200 ± 0.015
Cladding diameter:	125 μm ± 1 μm
Cladding Non-Circularity:	<2.0%
Coloured Fiber Diameter:	250 μm ± 15 μm
Buffering Diameter:	890 mm ± 50 mm
Minimum Tensile Strength:	100,000 psi
Fiber Minimum Bending Radius:	.75 in. (1.91 cm)
Cable Minimum Bending Radius: During Installation: After Installation:	20 times cable diameter 10 times cable diameter

Operating Temp. Range:	32°F to 122°F (0°C to 50°C)
Storage Temp. Range:	-40°F to 149°F (-40°C to 65°C)
Maximum Fiber Loss:	3.5 dB/km at 850 NM 1.5 dB/km at 1300 NM
Minimum Bandwidth:	1500 MHz.km at 850 nm (OFL) 500 MHz.km at 1300 nm (OFL) 2000 MHz.km at 850 nm (DMD, laser) 500 MHz.km at 1300 nm (DMD, laser)

Fibers must comply with TIA/EIA 568 specifications and OS2 fiber specification as in ISO 11801 standard. It shall comply with ITU G.652.D

Core	9 μm ± 3 μm
Core Non-Circularity:	<6%
Core/Cladding Concentricity Error:	<3.0 μm

Numerical Aperture:	0.200 ± 0.015
Cladding diameter:	125 μm ± 1 μm
Cladding Non-Circularity:	<2.0%
Minimum Tensile Strength:	1340N at installation and 400N after installation
Cable Minimum Bending Radius:	
During Installation:	230mm
After Installation:	150mm

Operating Temp. Range:	32°F to 122°F (0°C to 50°C)
Storage Temp. Range:	-104°F to 167°F (-40°C to 75°C)
Maximum Fiber Loss:	0.75 dB/km at 1310 NM 0.75 dB/km at 1550 NM

## 12. DATA OUTLET

The Contractor shall provide the identification labels at each and every information outlet with clear information of its connection. (TR, cabinet number, patch panel number and port number). The labeling shall be on the faceplate of the information outlet according to TIA/EIA 606 Administration Standard.

The contractor has to provide clear identification labels for Data.

In the process of installing the information outlets, if the Contractor envisages difficulty in mounting the outlet at planned location as indicated in its design/engineering drawing, the contractor shall notify the Company of this, the contractor shall not make its own discretion in modifying or changing any information provided in the approved design drawings.

The type of information outlets shall be of modular Tool less RJ45 of Matt Chrome/ metallic or any other approved(design engineer) finish, 8 position, 8 conductor with front cover designed for high speed networking applications that use data transmission rates over frequency ranges up to and potentially beyond 250 MHz & 100 MHz.

The 8 position/8 conductor outlet shall meet the category 6 transmission requirements for connecting hardware specified in ISO/IEC 11801 and EIA/TIA-568A/B and Class E design guidelines.

The modular outlet shall provide maximum versatility in designing a premise distribution system. It shall be designed to snap into modular faceplate. When the outlet is inserted into the faceplate or frame, it shall lock into place and shall only be released using the dual-purpose wire insertion tool. The mounting and removal system shall allow easy installation and modification. The faceplate jacks must be shutter protected and shall include a label window required to write circuit identification number. Each port must support a color icon to identify the port function.

The plastic used to construct the modular data outlet shall be of high impact, flame-retardant, made of poly pheylyene oxide with flammability rating meeting UL 94V-0UL, the jack wires shall be at least 50 micro-inch lubricated gold plating over 100 micro-inch nickel under plate. The connector shall be of copper alloy, at least 100 micro-inch bright solder over 100 micro-inch nickel under plate.

The insulation displacement connector shall accept 24/23 AWG solid copper wire conductors. The connector shall have multicolor labels marking wire terminals with numbers, assuring fast, accurate installation. The outlet must support wiring configuration as per T568A and T568B on the same RJ-45 jack

The connector shall be wired using the wire insertion tool (impact tool). The module shall be wired from the centre to the outside and shall not untwist paired conductors more than 12.7 mm. In the process of terminating the cables in patch panels/outlets the Contractor shall ensure ISO/IEC and TIA/EIA category 5E/6 transmission performance requirements.

### **13. PATCH CORDS**

The contractor shall supply patch cords for all the installed points on the network switch side as well on the workstation side. The cord length shall be of two different sizes 6-ft. [1.5 m] on the network switches side and 10 ft. [3.05 m] and 2m on the workstation side as per drawing and specifications.

The patch cable shall meet the requirements warranted to meet ISO/IEC 11801, EN 50173 and EIA/TIA 568A/B category 6 wiring standards capable of connecting high speed information terminal devices to information outlets, to interconnect information terminal devices and 8-position modular jack panel applications. The patch cord shall be designed to provide support for extended multimedia transmission distance over frequency ranges up to and potentially beyond 100/250 MHz.

The patch cord shall support the computer networking applications over frequency ranges up to and potentially beyond 250 MHz and shall be compatible with voice and information applications.

The construction of the cord shall be of Cat 6 stranded type cordage tightly twisted, 24 AWG, 8 conductor. The cord shall be terminated to an 8-position RJ-45 modular plug on both ends. The cords shall support the transmission requirements warranted to meet ISO/IEC 11801 Class E, EN 50173 or TIA/EIA 568B Category 6, Class E component specifications and standards.

The Contractor supplied cord shall be of factory crimped modular plug at both ends.

### **14. PATCH CORD ORGANIZER**

The Contractor shall supply and install sufficient patch cord organizers/ patch cord organizers that are used for routing patch cords in 19-inch (48.3-cm) frames. The patch cord organizers shall support the requirements of routing patch cords both at the equipment side as well as the Category 6-patch /Cat 6A panel cabling side at the wiring closets. These organizers shall be located in the 19-inch frame inside the wiring closet.

The Contractor supplied patch cord organizers/ patch cord organizers shall support the requirements of routing cords in both horizontal and vertical pathways.

#### **15. PATCH PANELS (JACK PANELS)**

The Contractor shall supply and install the modular patch panels to meet the full cabling system requirement of the "building/complex". Every category 6 cables serving the information outlets at work areas shall be terminated at the patch panels. The Contractor shall ensure that the supplied patch panels meet the ISO/IEC 11801, EN 50173 and TIA/EIA 568 warranted component specifications and standards.

The patch panels shall be of 19-inch rack-mounted panels. The rear of the panel shall feature connecting blocks mounted on a printed wiring board. These connecting blocks shall be capable for use in terminating category 6 station wires, equipment, or tie cables. The modular patch panel shall be capable of supporting up to 24 jack positions (ports) as required by the design drawings of the Data system and shall have the facility to write the circuit designation details at the front side of each jack. The contractor shall provide 20% spare capacity for both the Data and voice.

The insulating displacement connector field in the patch panel shall be made continuous to the 8-pin modular tool less jack field on front of the panel through printed wiring board connections to enhance the features to conform to TIA/EIA 568A/B cabling recommendations.

The construction of the modular jack panel shall be of category 6 – compliant and shall have the stringent requirements of connecting hardware as specified in TIA/EIA 568A/B commercial/ residential building Cabling System standards.

When the patch panels are tested in accordance with the appropriate test methods described in TIA/EIA 568 A/B and ISO/IEC 11801, EN 50173 Category 6 specifications. The modular patch panels shall meet the worst-pair near-end cross talk (NEXT) requirements over the entire frequency ranges up to and potentially beyond 100/250 MHz on all pair combinations.

Care must be taken to ensure that the cables are terminated correctly at category 6 cross connect hardware (patch panels).

The cable conductors shall be terminated as described in TIA/EIA 568A/B and ISO/IEC 11801, EN 50173 Category 6, Class E wiring sequence by using the proper insertion tool (impact tool).

When terminating the cables in the insulating displacement connector field, care must be taken to ensure that the strip – back is limited only as much cable jacket as is required to perform connecting hardware terminations. The cables shall be properly secure terminations. The cables shall be properly secured to the 19" rack with cable ties as well as at the patch panels.

Each port of the patch panel must support color Icon to identify the port function.

Each port must be numbered in sequence with white printing on black



background or other high contrast colors.

Each port on the patch panel must have a label place holder and for the patch panel number.

The package must include frame mounting screws, labels, cable ties and instruction sheet.

#### **16. CABLING CABINET (STEEL CABINET)**

The Contractor shall supply and install cabling System Cabinets to house the passive and active network equipment. The cabinets shall be freestanding / wall mounting types.

Two type of 42U free standing cabinet shall be used in IT rooms and in Data centre. Furthermore 12U & 18 U Racks shall be used in Gate Office. The technical specification is as per the following:

The Contractor supplied Cabling System cabinets shall meet the requirements of accommodating the high volume of cabling 19" 24-port patch panels & LAN Equipment fully assembled with the following items.

For data Centre rack Cabinet dimension 42U 600 mm x 1000 mm nominal width & depth). The cabinets must meet the following specifications:

- 42U 800 x 1000 Ready Rack
- 1600 KG load rating
- 42U 4mm Safety Glass Door (On the front).
- 42U 1.5 mm steel Door (On the rear).
- 800 x 1000 mm side vented top cover.
- Castors heavy duty braked.
- 42U Panel mounting angle kit.
- Thermostat controlled Low Noise Fan Tray.

For 12U Racks dimensions will be 800 x 800mm nominal width and depth

- 12U 800 x 800 Ready Rack
- 45 KG load rating
- 12U 1mm Safety Glass Door (On the front).
- 12U 1 mm steel Door (On the rear).
- 800 x 800 side vented top cover.
- 12U Panel mounting angle kit.

A power outlet strip shall have a 2 meter flying lead, (3-wire extension cord) with a 3 prong British plug with fuse and shall have 13 amp. 250 volt 3 prong British outlets with individual on/off switch and indicator light with mounting brackets. The AC Mains distribution integral at the rear pillar of the cabinet should have at least 10 of 13 amp. Power Outlets. Cable management panel inclusive of other accessories such as earthing kits, screws, washers, grip-nuts and a removable shelf, able to resist a weight of 50 to 60 kgs. The cabinets shall be rugged and strong and all steel shall be finished scratch proof in a durable enamel Grey paint on both sides.

The cabinets must include Low Noise Thermostat controlled fans and shall automatically switch on and off according to the temperature inside the

cabinets, the temperature range shall be from 10 to 60 degrees centigrade. The dimensions of the tray shall be of 600 mm x 800 mm. The fan tray shall have minimum of four fans 250 Volts AC + 6% 50 Hz. The low noise top mounted fan tray shall aid the cooling requirement of the LAN equipment installed inside the cabinets, and in the process of installing the fan tray on top of the cabinet it shall not occupy any of the usable U height in the cabinet.

The front glass door shall have at least 4 mm toughened & 50 percent light transmission smoked safety glass able to resist a weight of 80 to 100 Kgs. Placed within 200 mm of the door center. The door shall be lockable and shall have a swing handle supplied with 2 keys.

The rear door shall be the same as the front except the construction of the door shall be of rugged and strong 1.6mm steel finished in a durable enamel Grey paint on both sides, and without glass.

The internal panel mounting angles shall be supplied in pairs to provide 19" mounting positions with hole patterns to accept captive nuts on universal centers. In the design of the panel mounts the centers of each U height shall be notched, to make the positioning of cage nuts much simpler. The panel mounting shall be fitted onto panel mount angle supports to allow infinite adjustment throughout the depth of the track.

The cabinets shall be supplied at least with one shelf kit. The shelf should carry a load rating of 50 kgs. And shall be manufactured with holes/slots providing sufficient airflow to LAN equipment when installed inside the cabinets.

Four steel castors with rubber wheels at least 40 mm high. These castors shall be mounted at the corners of the cabinet and be able to support the total weight of the cabinet and all options.

The cabinets must support the installation of fire protection units and all 19" equipment including frames for 110-punch block.

The supplied cabinets must meet the following standards:

IEC 297-2  
D/N 4/494 Part 7  
D/N 4/491 Part 1  
Load rating 500 Kg  
Rust proof coating  
EN 60950  
VDE 0100  
Material 1.6mm steel  
Paint finish according to RAL 7035

The supplied cabinets must meet the following standards:

IEC 297-2  
D/N 4/494 Part 7  
D/N 4/491 Part 1  
Load rating 500 Kg  
Rust proof coating  
EN 60950  
VDE 0100

Material 1.6mm steel  
Paint finish according to RAL 7035

The supplied cabinets must meet the following standards:

IEC 297-2

D/N 4/494 Part 7

D/N 4/491 Part 1

Load rating 500 Kg

Rust proof coating

EN 60950

VDE 0100

Material 1.6mm steel

Paint finish according to RAL 7035

42 U free standing open frame

Integrated cable and cord management

allows for more efficient and effective cable management

Focused on accessibility

Extruded aluminium construction

Modular open frame design (no doors and side panels to remove)

Pre-threaded mounting holes

42U with 270 holes per vertical channel meets TIA/EIA RMU rack mounting unit dimension

Mounting screws with pilot point

Cable guides provide an effortless solution to transitioning cables

Flexible cable guides allow cable to snap-in easily for quick cable routing

Spacing of cable guides aligns exactly with the standard ISO 1101 rack

Unique switch gate Door / Cover provides easy access to the door

Edge protected pass through holes for transition of cables to rear side

## 17. VOICE CABLING SYSTEM

MTJB shall be provided at Admin Block for distribution. Incoming PTCL cable shall be coming from complex PTCL room located near complex main entrance. Each building shall have dedicated IDF racks which shall connect from MDF through Multipair backbone cable network.(It is part of infrastructure).

Wiring system used shall be star topology i.e. each telephone outlet is connected directly to the associated floor distributor (TJB).

Telephone system shall be supplied installed and tested complete in place including but not in a way of limitation, cables, socket outlets, 110 wiring block, connectors, telephone junction box and main distributor frame.

The telephone cabling System shall be designed using standard, proven equipment and materials with the latest Technology version or model. If there is any problem during warranty period related to the shortage of Materials, the Contractor shall supply them with no extra cost to the Project.

The design shall fully comply with TIA/ EIA 568B & ISO 11801 in a full star topology configuration collapsing in the MDF.

## 18. SCOPE

The contractor shall carefully examine all of the specifications to ensure that

he is fully conversant therewith and has included for everything necessary therein, either expressly provided for or as would normally be expected to be provided for by a reputable contractor specializing in the type and nature of the Services described in the Contract.

The Contractor is advised that items or matters not specifically provided for, or partially described or otherwise missing from the specifications, but which are nevertheless necessary for the execution and completion of the Services, shall be deemed to have been included by the Contractor.

The Contractor shall ensure that all selected manufacturers of equipment and materials provide with appropriate warranties and guarantees for their products.

Authorized and certified installers registered with their respective Manufacturers shall execute the installation of the Cabling system.

The Contractor shall also be required to submit, in their bid, a list of personnel along with their CV, certifying that the installers it intends to employ on the services have the necessary training and experience.

The Contractor shall carry out all the necessary surveys, design and engineering so as to provide for the Services, a whole and complete system to ensure full compatibility of the Services with any of the existing facilities pertinent to Cabling System applications & operations.

The scope of the Services include the provision of all material, labour, supervision, construction, equipment, tools, temporary, test equipment, spares, consumable and all other things and services required to engineer, design, supply, install, test and commission the Cabling System.

It is the responsibility of the Contractor to make sure that the system works at the company environment.

The Vendor must provide a list of project Reference within the last three years.

## **19. SUBMITTALS**

Product Data: Submit manufacturer's data on signal transmission media and components.

Shop Drawings: Submit layout drawings of telephone cable distribution system and accessories.

Wiring Diagrams: Submit data transmission wiring diagrams for telephone system, including TJB and terminal connections.

## **20. TELEPHONE CABLING**

Vertical runs between floors extending from the MTJB to each IDF Rack using multi pair 25 pair CAT 5e cables installed on cable tray.

The pair twist of the cables must be maintained as close to the termination at the patch panel IDC Modular outlet as possible. Cables shall not be untwisted for more than 12.7 mm. The cable conductor's entry shall be at the center of the IDC module and the module shall be wired from the center to the outside.

Cat 6 cable shall be used for cabling from IDC block to telephone outlet.

## 21. IDC WIRING SYSTEM

The IDC blocks shall be used for the voice cross connect and should be 19" rack mountable type. 100 pair and 50 pair IDC block to be used.

The IDC blocks shall be capable of terminating cables as stated in drawings.

Shall be capable to terminate 22-24 AWG solid conductors or 22-24 AWG stranded conductors.

Shall be made of high-impact UL 94V-0 rated thermoplastic.

Maximum insulated conductor outside diameter 0.05"

Complete kit includes connecting blocks, labels and label holders shall be used.

Jumper troughs shall be used to route cable horizontally and vertically.

The IDC connectors must be color coded to meet both T568A and T568B wiring Configuration.

The IDC connector on the back of the patch panel shall support 22 to 25 AWG solid conductors cables.

## 22. TELEPHONE JUNCTION BOX.

The telephone Junction Box (TJB) shall be made of 16 SWG sheet steel, anti-rust treated and painted to match the wall color, suitable for recess mounting and shall be of appropriate size to accommodate terminal strips with adequate space available for wiring. The terminal strip shall be made of copper, soldered type with suitable capacity for terminating all incoming and outgoing cables including direct lines. The strip shall be installed on insulated material sheet inside the sheet steel box.

The TJB shall be provided with a lockable hinged door, fastened to the steel outer Box by means of nuts and bolts.

## 23. QUALITY ASSURANCE:

Manufacturer's Qualifications: Firms regularly engaged in manufacture of signal transmission media and accessories of types required, whose products have been in satisfactory use in similar service for not less than 5 years.

Installer's Qualifications: Firms with at least 5 years of successful installation experience with projects utilizing systems and equipment similar to that required for this project.

Co-ordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of data system with other work.

Sequence installation of data system with other work to minimize possibility of damage and soiling during remainder of construction.

## 24.0 WIRELESS LAN:

Summary Standard: 100% coverage at -65dB controller based solution supports 802.11ac wave 2

Core/ Optional: Core

Hosting Location: University

Wireless LANs are required to provide internet access throughout the university premises. The selected vendor must ensure 100% WIFI signal coverage in computer labs, waiting rooms, demo rooms, departmental libraries etc.

WLAN engineering is required to support VoIP ( e.g skype, etc.) services related to business applications.

In converged networks, all wireless access points are considered capable of carrying associate back office traffic, regardless of their physical location at the property.

The strength of the WIFI must be -65dB, enough for a smartphone. The WIFI system controller is based and managed through a HSIA gateway.

To ensure compliance for above, the approved vendor for WIFI will require completing and providing relevant 'heat maps' and blue prints for WIFI topology. This will be conducted via a Site Survey during the initial design and at the final stages of university construction.

#### **24.0.1 SITE SURVEYS**

Conduct two mandatory wireless site surveys by a qualified wireless integrator to ensure adequate signal throughout the project coverage area. Depending upon the size of the property, the initial desktop survey can be performed using a passive ( application generated) survey of signal and noise statistics. The second physical survey must be conducted following the completion of wireless installation.

A. Initial Desktop Survey:

- Conduct initial survey by computer modeling based on construction documents.
- Identify architectural and structural elements that obstruct or diminish wireless signal strength.
- Conduct survey prior to completion of the low voltage drawing.

B. Physical Survey:

- Conduct the second survey on site following substantial completion of the exterior building envelope ( roofs and walls) and interior partitions to account for the impact of building materials ( drywalls and windows) and sources of EMI/ RFI signal strength.
- Provide details on items not yet installed involving water and large metal objects.
- Consider the presence of special coatings or materials ( e.g., UV) on windows if the interior wireless access points are intended to provide

coverage of exterior areas.

- Physical Survey Report shall include the following information:
- Map of signal, noise and user performance; Coverage by SSID (Service Set Identifier); Power level by access point
- The physical survey provides frame data rates; packet retries and error rates.

#### **24.0.2 WIRELESS ACCESS POINT ANTENNAS**

There are many types of antennas used with wireless access points. Use appropriate antenna types( e.g., wireless access points located outside utilize antennas designed for exterior use). Ensure that the Design Team is aware of the antenna dimensions used and accounts for appropriate allocation in the design. Generic access points are not acceptable.

Wireless Standards: Wireless access points shall support 802.11ac wave 2 standard.

#### **24.0.3 POWER OVER ETHERNET (POE+)**

Power must be provided to the wireless access points through the use of POE+ [ IEEE standard 802.3 af]

- The current standard for POE+ is outlined in the IEEE 802.3at standard.
- When POE+ is utilized, there is an impact on the LAN switch models/ modules used and therefore on the LAN switch infrastructure cost.
- The use of POE+ may impact power and cooling requirements for the IDF/ MDF where POE switches are located.
- If POE is not used, installation of additional power outlets in the vicinity of each wireless access point is required and increases construction costs.

## SECTION – E - 8 EARTHING SYSTEM

### 1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete earthing system as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and positions of the electrical lines and equipment.

The Earthing system with accessories shall also comply with the General Specifications for Electrical Works, Section E- I and with other relevant provisions of the Tender document.

### 2. GENERAL

The earthing system consists of earth electrodes, earthing leads, earth connecting points, earth continuity conductors and all accessories necessary for the satisfactory operation of the associated electrical system.

### 3. STANDARDS

The latest editions of the following standards / codes shall be applicable for the materials covered within the scope of this specification:

BS 951	Earthing Clamps
BS 1433	Hard drawn bare copper conductor for earthing.
BS 2874	Nuts, Bolts, Washers and Rivets for use on copper.
BS 6346	PVC Insulated Cables.
CP 1013	Earthing

Any other standard referred to in above standards or these specifications.

### 4. MATERIAL

#### 4.1 Earth Rod Electrodes

Drive extensible rods of the same diameter into the ground, as per detailed item mentioned in BOQ, to a suitable depth to obtain low resistivity in the particular soil.

Weld earth connectors to the top of the rods, in sufficient number to take all incoming cables.

#### 4.2 Earthing Lead

The earthing lead shall connect the earth electrode to earth connecting point or equipment in the building. It shall be round hard drawn bare electrolytic copper of size shown on the drawings. The cost of earthing leads deemed to have been included in the price of earth electrode & no separate pavement shall be made for it.

#### 4.3 Earth Continuity Conductor

Earth continuity conductor (E.C.C) shall be hard drawn bare copper wire or single core PVC insulated copper conductor cable of sizes



indicated on the drawings. All thimbles, lugs, sockets, nuts, washers and other accessories necessary for the complete installation of ECC shall be provided by the Contractor without any extra cost.

The specifications for single core PVC insulated cables used as E.C.C. shall be same as those given in section E - 3 of these specifications. PVC insulated cables when used as E.C.C. shall be green,

## 5. INSTALLATION

Complete earthing systems as shown on the drawing shall be installed by the Contractor. The earthing system shall give earth resistance, including resistance of soil, earth leads and E.C.C. equal to less than one ohm, this without ground pits water spraying.

The earthing system shall be loop connected with earthing cables at least 300 mm away from telephone cables. The concept of the main loops and the way they are connected shall be such that equipment / apparatus can be easily removed without requiring a complex disconnection operation nor risking interruption of / or damage to the loop itself. The fastening of the earthing conductors shall be made on a sufficient length so as to prevent crushing or cross section weakening. The parts on which they are connected shall be conveniently cleansed and surface.

Leads sheaths or steel tape armours are not permitted as grounding conductors. The earthing system shall be installed to ensure that when any part of the earthing system is disconnected for the purpose of carrying out periodic testing an alternative path to earth is available.

At all connections of earth continuity conductor to LV Switchboard, LV Distribution Board or any other metallic body, proper size or brass sockets, thimbles or lugs shall be used to which the copper wire shall be connected by copper brazing. The soldering of copper wire at joints or termination shall not be allowed. All tee-off connections shall be by copper brazing using suitable socket and clamps. After brazing, the jointed surface shall be protected by oxide inhibiting compound of low electrical resistance. For connections to metallic body, the surface shall be thoroughly cleaned before bolting the lug or socket.

The earth continuity conductor shall be in general run in cable trench or in conduits / pipes as shown on the drawings. For under floor runs, these shall be installed in pipe / conduit of appropriate sizes. Where laid along under ground cables, these shall be laid directly under ground in unpaved areas and in pipes under paved areas.

The electrode plate shall be installed at a minimum depth of 5 meters from finished ground level or 1 meter below permanent water level, whichever is less. The minimum horizontal distance between earth electrodes shall be 3 meters. Proper mixture of lime and charcoal in the ratio of 1 : 3 shall be made and buried along with the copper plate in the ground to increase the soil conductivity. The electrode shall be installed as per details shown on the drawings. The inspection chambers shall be constructed at locations approved by the Engineer.

A 50 mm diameter G.I. shall be provided from inspection chamber to earth plate for watering purposes. The pipe shall have 10 mm diameter holes at 500 mm center to center all along the length. At the ground level an inspection

chamber with cast iron cover shall be constructed having dimensions as shown on the drawings. The inspection chamber shall have a copper supported on angle iron frame. The cover shall be hinged type, as approved by the Engineer and shall finish flush with the ground level.

The earth connecting point shall be installed at locations shown on the drawings. It shall be fixed on wall surface by means of brass screws with nuts, washers and other insulating material as instructed by the Engineer.

The earth continuity conductor of sizes shown on the drawing shall be installed all along the cable runs and connected to the earthing bar / terminals provided in the equipment. The body of all Switchboards shall be connected to earth by specified size of E.C.C. All metal work shall also be connected to earth by specified size of E.C.C.

At any joint or termination, the E.C.C. shall be connected using proper accessories. No connection shall be made by twisting of earth conductors.

**SECTION – E – 09**  
**CABLE TRAY, LADDER AND TRUNKING**

**1. RELATED DOCUMENTS**

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**2. SUBMITTALS**

General: Submit the following according to the Division 1 Specification Sections.

Product data for each component. Show tray types, dimensions, and finishes. Determine the sizes of the cable trays based on the number and size of cables laid on the cable trays plus 20% space for future growth. Cables laid on cable trays shall be spaced twice their overall diameter (consider the largest cable as reference). In case of discrepancy with the contract documents this clause shall prevail, unless approved by the Engineer otherwise.

Shop drawings detailing fabrication and installation of cable tray, including plans, elevations, sections, details of components, and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice plates connectors, expansion joint assemblies, straight lengths, and fittings.

Co-ordination drawings, including floor plans and sections drawn to accurate scale. Show accurately scaled cable tray layout and relationships between components and adjacent structural and mechanical elements.

**3. QUALITY ASSURANCE**

Manufacturer Qualifications: Select a firm experienced in manufacturing cable trays which has a record of successful in-service performance.

Comply with the relevant standards of BS, NEMA and NEC.

Single-Source Responsibility: All cable tray components shall be the product of a single manufacturer.

**4. SEQUENCING AND SCHEDULING**

Co-ordination: Co-ordinate layout and installation of cable tray with other installations.

Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Engineer.

**5. CABLE TRAYS**

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

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

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

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

- a. Tray work shall have oval perforations. Ladder type trays shall be used as required and/or approved by the Engineer.

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

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

## 6. CABLE TRUNKING

Where required, wiring shall be run in hot-dipped galvanized (after fabrication) sheet steel cable trunking of the specified gauge complete with all fittings and accessories, manufactured and installed in accordance with BS 4678/NEMA. The trunking shall be constructed with return flanges. Trunking covers shall be secured by anchored turn-buttons and locking bars and minimum length of individual sections shall be 2.44-m. The trunking shall be suspended/supported from the structure at maximum 2-m intervals with straps and hangers fabricated from minimum 6-mm dia HDGF bars, or supported by angle-iron brackets.

Conduit drips from the trunking shall also be supported with hangers. Factory made connectors shall be used at joints.

Junctions (tee and 4-way) in multi-compartment trunking shall be double depth to avoid reduction in cabling space. Cable in vertical runs shall be supported by pin racks, prongs or bridging pieces. Fire barriers shall be provided at each floor level. Allowance for expansion shall be incorporated.

Bonding links shall be provided at each joint and secured by screws, nuts and shockproof washers. The bonding links shall make contact with the metal of the trunking of fitting, and continuity shall not depend on contact through the screws, nor on removal on site paint finish from ferrous metal.

## 7. EXAMINATION

Examine surfaces to receive cable tray, cable trunking and cable ladder for compliance with installation tolerances and other required conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

**8. WIRING METHODS**

Use cable tray of complete with manufacturer's recommended covers, barrier strips, dropouts, fittings, conduit adapters, hold-down devices, grommets, and blind ends.

**9. INSTALLATION**

- a. Install cable tray, cable trunking and cable ladder level and plumb according to manufacturer's written instructions, rough-in drawings, the original design, and referenced standards.
- b. Remove burrs and sharp edges of cable trays.
- c. Make changes in direction and elevation using standard fittings.
- d. Make cable tray connections using standard fittings.
- e. Locate cable tray above piping except as required for tray accessibility and as otherwise indicated.
- f. Fire stop penetrations through fire and smoke barriers, including walls, partitions, floors, and ceilings, after cables are installed.
- g. Working Space: Install cable trays with sufficient space to permit access for installing cables.

**10. GROUNDING**

Connect cable trays, cable trunking and cable ladder to ground as instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors.

**11. CLEANING**

Upon completion of installation of system, including fittings, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes, including chips, scratches, and abrasions.

## SECTION – E – 10 PUBLIC ADDRESS SYSTEM

### 1. SUMMARY

This Section includes equipment for amplifying, distributing, and reproducing sound signals.

### 2. DEFINITIONS

Retain abbreviation and terms that remain after this Section has been edited.

Channels: Separate parallel signal paths, from sources to speakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.

PA/VA Zone: Separate group of speakers and associated supply wiring that may be arranged for selective switching between different channels.

VU: Volume unit.

### 3. SUBMITTALS

Product Data: For the following:

Adjust list below to suit Project.

Voice Alarm Controller

Power Supply Manager

Power amplifiers.

Microphone.

Equipment rack.

Stereo Mixer

Speakers (Wall, ceiling etc).

Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

Field quality-control test reports.

Operation and maintenance data.

### 4. QUALITY ASSURANCE

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.

Comply with NFPA 70.

Comply with EN 60849 and EN 54-16 Standards as PA/VA.

### 5. COORDINATION

Coordinate layout and installation of system components and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

### 6. FUNCTIONAL DESCRIPTION OF SYSTEM

Descriptions below are offered as examples only. Revise this Article to convey design intent to Contractor and Installer. PA system has built in emergency voice evacuation system so that in case of emergency it shall override the announcement and allow prerecorded emergency message.

System Functions: Include the following:

- Emergency voice announcement shall be announced in the event of fire and the system manager shall interfaced with Fire alarm panel.
- Delete functions in subparagraphs below that are not required and edit remaining descriptions to suit Project; add other functions as required.
- Selectively connecting separate zones to different signal channels.
- Selectively amplifying sound among various microphone outlets and other inputs.
- Communicating simultaneously to all zones regardless of zone or channel switch settings.
- Paging, by dialing an extension from any local telephone instrument and speaking into the telephone.

Producing a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed. Reproducing high-quality sound that is free of noise and distortion at all speakers at all times during equipment operation including standby mode with inputs off; and output free of non uniform coverage of amplified sound. In case of emergency built in Emergency Voice Evacuation system shall enable and announce through speakers.

## 7. EQUIPMENT AND MATERIALS

Coordinate features to form an integrated system. Match components and interconnections for optimum performance of specified functions.

Modular equipment type using solid-state components, fully rated for continuous duty, unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 100 to 240 V, 50 Hz.

## 8. VOICE ALARM SYSTEM:

Comply with EN 54

Power Source: 31V DC, removable terminal blocks (4 pins)

Speakerline: 4 channels ( with AB speaker line output)

Audio Input: 4 inputs (Line: -20 dBV / Mic: -60 dBV / ANC sensor, phantom power selectable)

DSP: Feedback suppression, Equalizer/Filter, Compressor, Delay and Ambient Noise Control (ANC)

Control Input: 16 inputs, no-voltage make contact input, open voltage: 24 V DC, short-

circuit current: 2 mA

Fault Detection System: Short circuit, Open circuit, Method:

Voltage

detect ; Connector: RJ45 connector ; Connection Cable: CAT5-

STP

Power Amplifiers: 4

Dimensions (W x H x D): 482 x 132.6 x 345 mm (19", 3U)

Standby Amplifier: Input: 1, Output: 1 ; Max. Voltage/Current: 100 Vrms, 5 Arms ; Connector: Removable terminal block (2 pins) x 2

LAN A,B: No. of Connectors: 2 (LAN A, LAN B) ; Network I/F: 100BASE-TX ;  
Network

Protocol: TCP, UDP, ARP, ICMP, RTP, IGMP, FTP, HTTP ; Spanning tree  
 Protocol: RSTP ; AudioTransmission System: TOA Packet Audio ; Audio  
 Encoding Method: PCM ; Audio Sampling Frequency: 48 kHz, 16 bits  
 Connector: RJ45 connector ;  
 Connection Cable: CAT5 ; Max. Cable Distance: 100 m

## 9. DIGITAL POWER AMPLIFIER MODULE

Comply with EN 54  
 Power Source: 31V DC (operating range: 20 to 33 V DC)  
 Amplification System: Class D  
 Rated Output: 150W (at 100V line), 105W( at 70V line), 75W ( at 50V line)  
 Output Voltage: 100V(70V,50V selectable)  
 Frequency Response: 40 Hz to 20 kHz: - 5 to +1 dB  
 Max Capacitive Load: 0.5 uF  
 Distortion: 1 % or less (at 100 V line, A-weighted)  
 Min Resistive Load: 67Ω (100 V), 47Ω (70 V), 33Ω (50 V)

## 10. POWER SUPPLY MANAGER

Comply with EN 54  
 Power Source: 220 – 230 V AC, 50/60 Hz  
 Power Consumption: 2800 W max in total (at rated output with charging), 650  
 W max in total, 350 W max each (EN 60065)  
 Charging Method: Temperature compensated trickle charging  
 Battery Connection: One each positive and negative terminal, applicable  
 cable  
 diameter: AWG 6 – AWG 0 (AWG 1/0) (16 mm<sup>2</sup> – 50 mm<sup>2</sup>)  
 Line resistance within 4 mΩ/ total  
 Control Connector: RJ45 female connector for connecting the system and  
 cascade  
 connection, Shielded Twisted-pair straight cable (TIA/EIA-  
 568A  
 standard) Type of control signal: Battery check, AC power  
 status,  
 DC power status, charging circuit failure, battery failure,  
 and  
 communication  
 DC Power Output: 8 x 31 V (19 – 33 V) 25 A max. each, M4 screw terminal,  
 distance  
 between barriers: 11 mm 3 x 31 V (19 – 33 V) 5 A max. each,  
 removable terminal block (3 x 2 pins) 1 x 24 V (16 – 25 V) 0.3  
 A  
 max., removable terminal block (1 x 2 pins)  
 DC Power (AC Mode): Rated output: 2300 W (total DC power output), Peak  
 output:  
 2780 W (total DC power output)



**11. MULTICHANNEL DIGITAL POWER AMPLIFIERS FOR SENATE**

Comply with TIA/EIA SE-101-A.

Revise first paragraph below to suit Project.

Mounting	:	Rack mounted.
Output Power	:	2000W with 100V line voltage
at 20 $\Omega$		
Amplification System	:	Impedance. Class D
Frequency Response	:	Within plus 1 dB and minus 3 dB from 50 to 20,000 Hz.
Minimum Signal-to-Noise Ratio	:	100 dB, at rated output.
Total Harmonic Distortion	:	0.1% at 1 kHz and 0.3% at 100Hz to 20kHz.
Output Regulation	:	Less than 2 dB from full to no load.
Controls	:	On/off, input levels, and low-cut filter.
Input Sensitivity	:	Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
Power Requirement	:	220 to 240V AC 50/60 Hz
Total Output (all channel Driven)	:	500W at 1 kHz frequency with impedance of 19.6 $\Omega$
Number of channels	:	4
Output voltage per channel	:	100V with 100V line voltage at 20 $\Omega$ at 1kHz
Mounting	:	Rack mounted.
Rated Output Power	:	550W X 4 with impedance of 4 $\Omega$
Amplification System	:	Class D
Frequency Response	:	Within plus 1 dB and minus 2 dB from 20 to 20,000 Hz.
Minimum Signal-to-Noise Ratio	:	100 dB, at rated output.
Total Harmonic Distortion	:	0.1% at 1 kHz and 0.15% at 20Hz to 20kHz.
Output Regulation	:	Less than 2 dB from full to no load.
Controls	:	On/off, input levels, and low-cut filter.
Input Sensitivity	:	Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
Power Requirement	:	120V AC 50/60 Hz
Number of channels	:	4

**12. MULTICHANNEL DIGITAL POWER AMPLIFIERS FOR SEMINAR**

Comply with TIA/EIA SE-101-A.

Revise first paragraph below to suit Project.

Mounting	:	Rack mounted.
Output Power line	:	2 channels: 250W x 2 with 100V and 40 ohm impedance
Amplification System	:	Class D
Frequency Response	:	Within plus 1 dB and minus 3 dB from 50 to 20,000 Hz.
Minimum Signal-to-Noise Ratio	:	100 dB, at rated output.
Total Harmonic Distortion	:	0.1% at 1 kHz and 0.3% at 100Hz to 20kHz.
Output Regulation	:	Less than 2 dB from full to no load.
Controls	:	On/off, input levels, and low-cut filter.
Input Sensitivity	:	Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
Power Requirement	:	220 to 240V AC 50/60 Hz
Total Output (all channel Driven)	:	580W with impedance of 40 Ω and 100V output line
Number of channels	:	2
Output voltage per channel	:	100V with 100V line voltage at 40 Ω at 1kHz
Mounting	:	Rack mounted.
Option	:	Matching Transformer. Power cord, removable terminal plug

**13. DIGITAL STEREO MIXER FOR SENATE**

Mounting	:	Rack mounted.
Frequency Response	:	20Hz to 20kHz
Sampling Frequency	:	48kHz
Input Channel	:	8 monaural and 7 stereo inputs
Total Harmonic Distortion	:	0.03% or less, 1kHz in rated 20 to 20kHz band pass frequency.
Output	:	4 output channels with 4 dB with 24dB max with 1 recording output
Power Requirement	:	24V DC Phantom power
Software	:	Dedicated GUI facilitating high precision parameter setting adjustment on PC via Ethernet LAN
Configuration	:	Stand alone system with 4U mountable. It can be used with digital speaker processor as optional
Features	:	<ol style="list-style-type: none"> <li>1. Feedback suppression function that eliminates feedback caused by microphone.</li> <li>2. It shall have automatic resonance control measurement and processing algorithm that</li> </ol>

optimizes speech and sound clarity for individual acoustic environments.

3. Automatic stereo input (Auto mute or Ducker) function that mutes stereo input automatically when detecting a monaural control signal.

#### 14. GOOSENECK MICROPHONE FOR SENATE

Microphone	:	Comply with TIA/EIA SE-105.
Type	:	Electret condenser element with cardioids polar pattern
Phantom supply	:	9 to 52V DC
Output Connector	:	XLR – 3- 12 equivalent
Cable	:	C25J
Mounting	:	Desk stand with push to talk application, press to talk switch. It shall be mounted on base stand.

#### 15. WIRELESS HANDHELD MICROPHONE FOR SENATE

Microphone	:	Comply with TIA/EIA SE-105
Type	:	Dynamic or unidirectional characteristic with built in antenna
Channel selection	:	64
Maximum input level	:	132dB SPL
Supporting accessory	:	Wireless transmitter
Power requirement	:	2, 6 or 12 single AA rechargeable batteries

#### 16. REMOTE DIPOLE ANTENNA FOR SENATE

Power requirement	:	7 to 12V DC ( from amplifier or wireless tuner)
Receiving Frequenc	:	550 to 932 UHF MHz
Dipole Ratio Relative Gain	:	8dB or more
Voltage Standing Wave Ratio	:	3
Output Impedance	:	75 $\Omega$
Accessories	:	M3.5 screw for wiring box, Tapping screw M4 for wiring wall and RG6/U and RG11/U sleeves

#### 17. CD / USB / MP3 / TUNER PLAYER FOR SENATE:

Power source	:	7 to 12V DC ( from amplifier or wireless tuner)
Receiving Frequency	:	550 to 932 UHF MHz
Dipole Ratio Relative Gain	:	8dB or more
Voltage Standing Wave Ratio	:	3
Output Impedance	:	75 $\Omega$
Accessories	:	M3.5 screw for wiring box, Tapping screw M4 for wiring wall and RG6/U and RG11/U sleeves(optional)

**18. LINE MATCHING TRANSFORMER FOR SENATE:**

Rated Input	:	200W
Primary Impedance	:	50Ω on 100V line and 25Ω on 70V line
Secondary Impedance	:	8Ω
Supporting equipment	:	Mounting Brackets and it shall work with line array speakers with option of speaker rigging frame

**19. SUBWOOFER SYSTEM FOR SENATE:**

Subwoofer systems contains 15" cone type woofer as speaker component with optional speaker rigging frame.

Power handling capacity	:	Continuous pink noise: 200W
Continuous program	:	600W
Impedance	:	8Ω
Sensitivity	:	93dB
Frequency Response	:	40 Hz – 400 Hz

**20. LINE ARRAY SYSTEM FOR SENATE:**

It shall work on 4 different angles 15°, 30°, 45° and 60°.

Power handling capacity	:	Continuous pink noise: 200W
Continuous program	:	600W
Impedance	:	8Ω
Sensitivity on 60° mode	:	96dB
Sensitivity on 45° mode	:	97dB
Sensitivity on 30° mode	:	98dB
Sensitivity on 15° mode	:	99dB
Frequency Response on 60° mode:	:	95 Hz – 20 kHz
Frequency Response on 45° mode:	:	100 Hz – 20 kHz
Frequency Response on 30° mode:	:	105 Hz – 20 kHz
Frequency Response on 15° mode:	:	110 Hz – 20 kHz
Finish	:	Polypropylene or as required
Water Protection	:	IPX4 ( install with every speaker module downward)
Accessories	:	Line matching transformer, speaker stand adapter and speaker mounting bracket and hanging bracket
Enclosure	:	Bass reflex type or sealed type

**21. UHF WIRELESS TUNER FOR SENATE:**

Channels	:	64 selectable frequencies
Power Requirement	:	AC Mains ( supplied AC – DC adapter must be used
Receiving Frequency	:	576 – 932 MHz
Harmonic Distortion	:	1 % or less (typical)
Signal to Noise Ratio	:	110dB or more
Frequency Response	:	within ± 3dB from 100 Hz to 15 kHz
Accessory	:	AC – DC adapter with rack mounting kit

Channel Check	:	Built in usable frequency scanning
Antenna Input	:	75 $\Omega$ with phantom powering for antenna which is 9V DC 30 mA maximum current consumption

## 22. MULTICHANNEL DIGITAL POWER AMPLIFIERS FOR LECTURE HALL

Comply with TIA/EIA SE-101-A.  
Revise first paragraph below to suit Project.

Mounting	:	Rack mounted.
Output Power	:	2000W with 100V line voltage at 20 $\Omega$ impedance.
Amplification System	:	Class D
Frequency Response	:	Within plus 1 dB and minus 3 dB from 50 to 20,000 Hz.
Minimum Signal-to-Noise Ratio	:	100 dB, at rated output.
Total Harmonic Distortion	:	0.1% at 1 kHz and 0.3% at 100Hz to 20kHz.
Output Regulation	:	Less than 2 dB from full to no load.
Controls	:	On/off, input levels, and low-cut filter.
Input Sensitivity	:	Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
Power Requirement	:	220 to 240V AC 50/60 Hz
Total Output (all channel Driven)	:	500W at 1 kHz frequency with impedance of 19.6 $\Omega$
Number of channels	:	4
Output voltage per Channel	:	100V with 100V line voltage at 20 $\Omega$ at 1kHz
Mounting	:	Rack mounted.
Rated Output Power	:	550W X 4 with impedance of 4 $\Omega$
Amplification System	:	Class D
Frequency Response	:	Within plus 1 dB and minus 2 dB from 20 to 20,000 Hz.
Minimum Signal-to-Noise Ratio	:	100 dB, at rated output.
Total Harmonic Distortion	:	0.1% at 1 kHz and 0.15% at 20Hz to 20kHz.
Output Regulation	:	Less than 2 dB from full to no load.
Controls	:	On/off, input levels, and low-cut filter.
Input Sensitivity	:	Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
Power Requirement	:	120V AC 50/60 Hz
Number of channels	:	4

## 23. DIGITAL STEREO MIXER FOR LECTURE HALL

Mounting	:	Rack mounted.
Frequency Response	:	20Hz to 20kHz
Sampling Frequency	:	48kHz
Input Channel	:	8 monaural and 7 stereo inputs
Total Harmonic Distortion pass frequency.	:	0.03% or less, 1kHz in rated 20 to 20kHz band
Output with 1 recording output	:	4 output channels with 4 dB with 24dB max
Power Requirement	:	24V DC Phantom power
Software	:	Dedicated GUI facilitating high precision parameter setting adjustment on PC via Ethernet LAN
Configuration	:	Stand alone system with 4U mountable. It can be used with digital speaker processor as optional
Features	:	1.Feedback suppression function that eliminates feedback caused by microphone.  2. It shall have automatic resonance control measurement and processing algorithm that optimizes speech and sound clarity for individual acoustic environments  3. Automatic stereo input (Auto mute or Ducker) function that mutes stereo input automatically when detecting a monaural control signal.

#### 24. DIGITAL STEREO MIXER FOR SEMINAR:

Mounting	:	Rack mounted.
Frequency Response	:	20Hz to 20kHz
Power consumption	:	14W
Power source	:	220-240V AC, 50/ 60 Hz
Sampling Frequency	:	48kHz
Input Channel	:	6 monaural and 3 stereo inputs
Total Harmonic Distortion	:	0.03% or less, 1kHz in rated 20 to 20kHz band pass frequency.
Output terminal	:	2 monaural output channels , removable  blocks, 1 stereo output, and 1 stereo recording
Power Requirement	:	24V DC Phantom power
Software	:	Dedicated GUI facilitating high precision parameter setting adjustment on PC via Ethernet LAN
Configuration	:	Stand alone system with 4U mountable. It can be used with digital speaker processor as optional
Features	:	1.Feedback suppression function that

eliminates feedback caused by microphone.

2. It shall have automatic resonance control measurement and processing algorithm that optimizes speech and sound clarity for individual acoustic environments

3. Automatic clipguard function for 6 each monaural input channel with independent settings for each channel.

4. Automatic mute function with on/off function switch

Accessory : Power cord, Removable terminal plug, rack mounting screw.  
 mounting : Power cord, Removable terminal plug, rack mounting bracket, machine and rack screw.

**25. GOOSENECK MICROPHONE FOR SENATE HALL, SEMINAR:**

Microphone : Comply with TIA/EIA SE-105.  
 Type : Electret condenser element with cardioids polar Pattern  
 Phantom supply : 9 to 52V DC  
 Output Connector : XLR – 3- 12 equivalent  
 Cable : C25J  
 Mounting : Desk stand with push to talk application, press totalk switch. It shall be mounted on base stand.

**26. WIRELESS HANDHELD MICROPHONE FOR SENATE HALL, SEMINAR & STUDENT FACILITY CENTER:**

Microphone : Comply with TIA/EIA SE-105  
 Type : Dynamic or unidirectional characteristic with built in antenna  
 Channel selection : 64  
 Maximum input level : 132dB SPL  
 Supporting accessory : Wireless transmitter  
 Power requirement : 2, 6 or 12 single AA rechargeable batteries

**27. UHF WIRELESS RECEIVER FOR SENATE HALL, SEMINAR & STUDENT FACILITY CENTER**

Channels : 64 selectable frequencies  
 Power Requirement : AC Mains ( supplied AC – DC adapter must be used  
 Receiving Frequency : 576 – 932 MHz  
 Harmonic Distortion : 1 % or less (typical)  
 Signal to Noise Ratio : 110dB or more  
 Frequency Response : within ± 3dB from 100 Hz to 15 kHz

Accessory	:	AC – DC adapter with rack mounting kit
Channel Check	:	Built in usable frequency scanning
Antenna Input	:	75 Ω with phantom powering for antenna which is 9V DC 30 mA maximum current consumption

**28. REMOTE MICROPHONE:**

Power Source	:	24 V DC (operating range: 15 - 40 V DC),
Current Consumption	:	240 mA or less
Microphone	:	Unidirectional electret condenser microphone with AGC (ON/OFF selectable)
Volume Control	:	Microphone volume, Monitor speaker volume, Chime volume (using the software)
Connectable Cable Shielded (CAT5-connector)	:	Main line: Shielded CPEV cable or Category 5 twisted pair cable for LAN (STP), Branch line: Shielded Category 5 twisted pair cable (CAT5-STP), RJ45
Operation:	:	Emergency/all-zone emergency broadcast key, Talk key, 13 Function keys

**29. COMPONENTS:**

Parameters listed in this Article are typical values. Performance and product characteristics vary among manufacturers. Revise to suit Project.

Microphone Type	:	Comply with TIA/EIA SE-105. Dynamic, with cardioids polar or unidirectional characteristic
Impedance	:	120 ohms.
Frequency Response	:	Uniform, 60 to 20,000 Hz.
Output Level	:	Minus 58 dB minimum.
Finish	:	Satin chrome and as required.
Cable	:	C25J.
Mounting	:	Desk stand with integral-locking, press-to-talk switch.
Equipment Rack	:	Comply with TIA/EIA-310-D. House amplifiers and auxiliary equipment in standard TIA/EIA 19-inch (483-mm) racks.

Group items of same function together, either vertically or side by side, and arrange controls symmetrically.

Power-Supply Connections: Approved plugs and receptacles.



Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.

Blank Panels	:	Cover empty space in equipment racks so entire front of rack is occupied by panels.
Enclosure Panels	:	Ventilated rear and sides and solid top. Use louvers in panels to ensure adequate ventilation.
Finish	:	Uniform, baked-enamel factory finish over rust-inhibiting primer or as required.
Power-Control Panel	:	On front of equipment housing, with master power on/off switch and pilot light; and with socket for 5-A cartridge fuse for rack equipment power.
Service Light	:	At top rear of rack with an adjacent control switch.
Vertical Plug Strip	:	Grounded receptacles, 12 inches (300 mm) o.c. the full height of rack, to supply rack-mounted equipment.
Maintenance Receptacles:		Duplex convenience outlets supplied independent of vertical plug strip and located in front and bottom rear of rack.
Spare Capacity	:	20 percent spare space capacity in rack for future equipment. Coordinate paragraph and subparagraphs below with Drawings.
Insulation for Wire in Conduit	:	Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
Microphone Cables	:	Neoprene jacketed, not less than 2/64 inch (0.8 mm) thick, over shield with filled interstices. Shield No. 34 AWG tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent. Plenum Cable: Listed and labeled for plenum installation.

### 30. CEILING SPEAKERS:

It shall be compliant with EN 54

Rated power : 6/3/1.5/0.75W  
SPL : 96 dB  
Frequency : 100 Hz to 16 kHz

### 31. SURFACE MOUNT CEILING SPEAKERS:

It shall be compliant with EN 54

Rated power : 6/3/1.5/0.8W  
SPL : 96 dB  
Frequency : 100 Hz to 16 kHz  
Speaker Component: 12cm dynamic cone type

### 32. LINE ARRAY SPEAKER FOR SEMINAR:

It shall be compliant with EN 54

Power handling capacity : 180W  
SPL : 92 dB  
Frequency range : 80Hz to 18kHz  
Impedance : 8 ohm  
Option : Matching Transformer with 100V in primary side and 8ohm on secondary side, Digital Processor, Wall mounting Bracket and wall mounting tilt brackets.

### 33. EXECUTION INSTALLATION

#### Wiring Method

Install wiring in raceways except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum-board partitions where cable wiring method may be used. Use plenum cable in environmental air spaces including plenum ceilings. Conceal cables and raceways except in unfinished spaces.

Install exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings so designed and installed to avoid damage to cables. Secure cable at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, or fittings.

#### Wiring within Enclosures

Bundle, lace, and train conductors to terminal points with no excess use lacing bars in cabinets.

Control-Circuit Wiring: Install number and size of conductors as recommended

by system manufacturer for control functions indicated.

### **Separation of Wires**

Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

### **Splices, Taps, and Terminations**

Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

### **Identification of Conductors and Cables**

Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

Wall-Mounting Outlets: Flush mounted.

Floor-Mounting Outlets: Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.

Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.

Speaker-Line Matching

Transformer Connections: Make initial connections using tap settings indicated on Drawings.

Connect wiring according to Division 16 Section "Conductors and Cables."

## **34. GROUNDING**

Revise this Article to suit system requirements. Include grounding electrodes for special applications only.

Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

Install grounding electrodes as specified in Division 16 Section "Grounding and Bonding."

## **35. FIELD QUALITY CONTROL**

Perform the following field tests and inspections and prepare test reports: Schedule tests with at least seven days' advance notice of test performance. After installing public address and music equipment and after electrical circuitry has been energized, test for compliance with requirements.

### **Operational Test**

Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.

Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:

Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.

Repeat test for each separately controlled zone of loudspeakers.

Minimum acceptance ratio is 50 dB.

Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.

Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in the same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.

Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.

Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Division 16 Section "Grounding and Bonding."

Retesting: Correct deficiencies, revising tap settings of speaker-line matching transformers where necessary to optimize volume and uniformity of sound levels, and retest. Prepare a written record of tests.

Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

## **36. ADJUSTING**

On-Site engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

**37. DEMONSTRATION**

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain public address and music equipment. Refer to Section 01.

**38. EXECUTION INSTALLATION****Wiring Method**

Install wiring in raceways except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum-board partitions where cable wiring method may be used. Use plenum cable in environmental air spaces including plenum ceilings. Conceal cables and raceways except in unfinished spaces.

Install exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings so designed and installed to avoid damage to cables. Secure cable at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, or fittings.

2 core 2.5 sqmm flexible PVC cable shall be used for wiring.

**Wiring within Enclosures**

Bundle, lace, and train conductors to terminal points with no excess use lacing bars in cabinets.

Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.

**Separation of Wires**

Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

**Splices, Taps, and Terminations**

Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

**Identification of Conductors and Cables**

Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

Wall-Mounting Outlets: Flush mounted.

Floor-Mounting Outlets: Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted

areas.

Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.

Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.  
Connect wiring according to Division 16 Section "Conductors and Cables."

### 39. **GROUNDING**

Revise this Article to suit system requirements. Include grounding electrodes for special applications only.

Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

Install grounding electrodes as specified in Division 16 Section "Grounding and Bonding."

### 40. **FIELD QUALITY CONTROL**

Perform the following field tests and inspections and prepare test reports: Schedule tests with at least seven days' advance notice of test performance. After installing public address and music equipment and after electrical circuitry has been energized, test for compliance with requirements.

#### **Operational Test**

Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.

Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:

Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.

Repeat test for each separately controlled zone of loudspeakers.  
Minimum acceptance ratio is 50 dB.

Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.

Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure

level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in the same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.

Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.

Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Division 16 Section "Grounding and Bonding."

Retesting: Correct deficiencies, revising tap settings of speaker-line matching transformers where necessary to optimize volume and uniformity of sound levels, and retest. Prepare a written record of tests.

Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

**41. ADJUSTING**

On-Site engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

**42. DEMONSTRATION**

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain public address and music equipment. Refer to Division 1 Section.

**SECTION – E – 12**  
**IP BASED CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM**

**1.0 GENERAL**

- A. All equipment and materials used shall be standard components that are regularly manufactured and used in the manufacturer's system.
- B. All systems and components shall have been thoroughly tested and proven in actual use.
- C. All systems and components shall be provided with the availability of a toll-free, 24-hour technical assistance program (TAP) from the manufacturer. The TAP shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge for as long as the product is installed.
- D. All systems and components shall be provided with a one-day turnaround repair express and 24-hour parts replacement. The repair and parts express shall be guaranteed by the manufacturer on warranty and non warranty items.

**2.0 GENERAL SPECIFICATIONS**

**IP MEGAPIXEL CAMERA (INDOORWALL TYPE):**

The camera shall be compact rugged, IR, 0 Lux 2 MP 1/2.8" CMOS image sensor format digital color having the horizontal resolution of 1280x720 TVL or above with outstanding picture quality and focal lens of 3.3 to 9mm. The camera shall provide easy installation, digital signal processing, on screen displays, superior picture quality reliability. The camera shall accept AC or DC POE type. The camera shall provide auto-detection of lens type with lens wizard. The camera shall provide night sense feature to extend the excellent sensitivity in low light conditions.

The camera shall provide automatic sensing for tracking white balance. The camera shall support bidirectional communication technology using standard video cable. The camera shall be line locked to the power line zero crossing to ensure roll free vertical interval video switching and recording.

The rated voltage shall be 12VDC, 24 VAC 50 Hz and POE option. The operating temperature shall be -20 to 50 degree Celsius. Humidity shall be 5 to 93% non condensing. Shock resistance shall be minimum 50 gm.

Signal to Noise Ratio	:	50 dB
Electronic shutter	:	AES or 1/77000 sec.
White Balance	:	Automatic sensing, (2500 – 9000K)
Video output	:	Composite video 1.0 Vp-p, 75 ohms.
Aperture correction	:	Horizontal and vertical, symmetrical.
BLC	:	Center window weighting
Synchronization	:	Line Lock
		(When powered by AC only)
		Synchronizes the camera to the
		power line zero crossing for roll-free



		vertical interval switching. (When DC supply) Internal crystal.
Video Compression	:	H. 264, multicast streaming.
Networking	:	10/100/1000 Mbps gigabit Ethernet, RJ-45
Viewing Requirement	:	ONVIF
Field Of View	:	31 to 87, 25 to 880, 35 to 105 (Horizontal, Vertical & Diagonal)
Image Resolution	:	Main stream 1280 x 720 @ 25/30 fps. Feature: Extra stream shall be provided.
Audio Compression	:	Built-in
Support Protocol	:	TCP/IP, UDP, SMTP, UPNP, FTP, HTTP or etc.
Data Storage	:	Video or Snapshot. Built-in (Micro SD).
Low light Capabilities	:	0.0013 Lux. Additional feature should be removable IR cut filter mechanism for increased sensitivity.
Lens	:	DC Iris.
Security	:	Password protection, IP address filtering, user access log.
Users	:	10 Simultaneous users.
Video Analytic	:	Adaptive motion analytic to intelligently detect motion within the field of vision and trigger an alarm. Also detects vehicles near sensitive areas longer than the users define time. Also count the objects that enter in a define zone. Also any object placed in a define zone and then trigger alarm. Cameras shall have maximum feature which shall meet clients requirements.
Imaging Device	:	16:9 Aspect Ratio 1/3 inch, effect 4:3 Aspect ratio 1280 x 720 @ 1.3 MP x1.
Cabling type	:	Cat-6
Alarm Pan Input	:	22 to 34 VAC 24 VAC nominal or POE.
Alarm I/P	:	10 VDC max, 75 mA max
Alarm O/P	:	0 to 15 VDC max, 75 mA.
Service Port	:	External 3 Connection 2.5 m pwds.
Certification	:	FCC, CE, UL/UL Listed.

### 3.0 INDOOR TYPE IP CAMERA (DOME TYPE):

The camera shall be compact rugged, IR with 0 lux 2 Mega pixel 1/2.8" CMOS (3 to 12 mm) varifocal lens & image sensor format digital color having the horizontal resolution of 1280x720 TVL or above with outstanding picture quality. The camera shall provide easy installation, digital signal processing, on screen displays, superior picture quality reliability. The camera shall accept AC or DC POE type. The camera shall provide auto-detection of lens type with lens wizard. The camera shall provide night sense feature to extend the excellent sensitivity by a factor 3 in low light conditions. They shall be mounted on ceilings as indicated in drawing.

The camera shall provide automatic sensing for tracking white balance. The camera shall support bidirectional communication technology using standard video cable. The camera shall be line locked to the power line zero crossing to ensure roll free vertical interval video switching and recording.

The rated voltage shall be 12VDC, 24 VAC 50 Hz and POE option. The operating temperature shall be -20 to 50 degree Celsius. Humidity shall be 5 to 93% non condensing. Shock resistance shall be minimum 50 gm.

Signal to Noise Ratio	:	50 dB
Electronic shutter	:	Automatic, 1/5 to 1 /132,000 sec. CCIR, 1/60 to 1/150000 sec. (EIA)
White Balance	:	Automatic sensing, (2500 – 9000K)
Video output	:	Composite video 1.0 Vp-p, 75 ohms.
Aperture correction	:	Horizontal and vertical, symmetrical.
BLC	:	Center window weighting
Synchronization	:	Line Lock (When powered by AC only) Synchronizes the camera to the power line zero crossing for roll-free vertical interval switching. (When DC supply) Internal crystal.
Video Compression	:	H. 264, multicast streaming.
Networking	:	10/100/1000 Mbps gigabit Ethernet, RJ-45
Viewing Requirement	:	ONVIF
Field Of View (mm)	:	24 to 65, 15 to 37, 28 to 75 (Horizontal, Vertical & Diagonal)
Image Resolution	:	Main stream 1280 x 720 @ 25/30 fps. Feature: Extra stream shall be provided.
Audio Compression	:	Built-in
Support Protocol	:	TCP/IP, UDP, SMTP, UPNP, FTP, HTTP or etc.
Data Storage	:	Video or Snapshot. Built-in (Micro SD).
Low light Capabilities	:	0.0013 Lux. Additional feature should be removable IR cut filter mechanism for increased sensitivity.
Lens	:	DC Iris.
Security	:	Password protection, IP address filtering, user access log.
Users	:	10 Simultaneous users.
Video Analytic	:	Adaptive motion analytic to intelligently detect motion within the field of vision and trigger an alarm. Also detects vehicles near sensitive areas longer than the users define time. Also count the objects that enter in a define zone. Also any object placed in a define zone and then trigger alarm. Cameras shall have maximum feature which shall meet clients requirements.
Imaging Device	:	16:9 Aspect Ratio 1/3 inch, effect 4:3

Cabling type	:	Aspect ratio 1280 x 720 @ 1.3 MP x1.
Pan I/P	:	Cat-6
Alarm I/P	:	22 to 34 VAC 24 VAC nominal or POE.
Alarm O/P	:	10 VDC max, 75 mA max
Service Port	:	0 to 15 VDC max, 75 mA.
Certification	:	External 3 Connection 2.5 m pwds.
	:	FCC, CE, UL/UL Listed.

**4.0 OUTDOOR TYPE PTZ CAMERA:**

The camera shall be compact weather proof, IP Speed Dome 36 x optical zoom format digital color having the horizontal resolution of 18 x DIGITAL ZOOM 1080 resolution or above with outstanding picture quality. The camera shall provide easy installation, digital signal processing, on screen displays, superior picture quality reliability. The camera shall accept AC or DC POE type. The camera shall provide auto-detection of lens type with lens wizard. The camera shall provide night sense feature to extend the excellent sensitivity by a factor 3 in low light conditions.

The camera shall provide automatic sensing for tracking white balance. The camera shall support bidirectional communication technology using Cat-6. The Cameras shall high speed pan up to 260°/sec and tilt up to 120°/sec. built-in web browsing.

The rated voltage shall be 12VDC, 24 VAC 50 Hz and POE option. The operating temperature shall be -20 to 50 degree Celsius. Humidity shall be 5 to 93% non condensing. Shock resistance shall be minimum 50 gm.

Image Sensor	:	1/4" CCD
Signal to Noise Ratio	:	50 dB
Electronic shutter	:	Automatic, 1/5 to 1 /132,000 sec. CCIR, 1/60 to 1/150000 sec. (EIA)
White Balance	:	Automatic sensing, (2500 – 9000K)
Video output	:	Composite video 1.0 Vp-p, 75 ohms.
Aperture correction	:	Horizontal and vertical, symmetrical.
BLC	:	Center window weighting
Synchronization	:	Line Lock (When powered by AC only) Synchronizes the camera to the power line zero crossing for roll-free vertical interval switching. (When DC supply) Internal crystal.
Video Compression	:	H. 264, multicast streaming.
Networking	:	10/100/1000 Mbps gigabit Ethernet, RJ-45
Viewing Requirement	:	ONVIF
Field Of View (mm)	:	24 to 65, 15 to 37, 28 to 75 (Horizontal, Vertical & Diagonal)
Resolution	:	530 TVL
Sensor Element	:	PAL 752 (H) x 582 (V)
Lens Type	:	36 x optical zoom, 12 x digital zoom.
Focal Length	:	F1.6 ≈r 3.8 f=3.4≈122.4mm.
Illumination	:	1.4 lux /0.01 lux.
Pan Range	:	On 360° Continuous, Speed 0.5 or

		260°/sec.
Preset Point/ Tour	:	32 Preset, 16 Camera tour.
Focus	:	Auto/manual.
Video Capture	:	H.264,4CIF/CIF/QCIF
MJPEG	:	4CIF/CIF/QCIF
Image Frame rate	:	30 fps (N), 25 fps (P) for all resolution.
2 way audio	:	Simplex/Duplex 2 way audio.
Lan port	:	RJ45 Connector, 10/100 M auto.
Alarm/out	:	Dry contact or relay output standard.
RS 485	:	For external keyboard.
Audio In/Out	:	Microphone in/out.
Video Out	:	1.0 Vp-p/75Ω Bnc optional.
Motion Detection	:	1.5 Zone.
OS	:	Windows based.
Security	:	Password protection.
Certification	:	FCC, CE, UL

### 5.0 MANUFACTURER'S WARRANTY

Repair or replacement of defective parts for a period of two years from the date of shipment, installation.

### 6.0 IP Video Management Systems (VMS):

- A. IP VMS shall support minimum 128 channel.
- B. IP VMS shall provide 6 to 10 Mbps for recording of IP video stream, play back and export.
- C. IP VMS shall support recording of H.264, JPEG, and MPEG-4 IP Stream.
- D. IP VMS shall support third party H.264 Megapixel video stream up to 10Mps resolution with total system throughout recording of all IP & analog streams, playback and export.
- E. The IP VMS shall have fully open architecture with support for both IP Specific Cameras and as well as ONVIF Compliance.
- F. The VMS shall support H.264 compression, CIF 4CIF resolution at maximum 100 FPS, 16audio input and RS422/485 PTZ Control with supplied system/ third party compatible protocol.
- G. VMS shall support unlimited no's of system connected over network. Each system shall contain maximum network ports, one for IP Camera/Encoder data, 1 for client computer access.
- H. VMS shall view, managed, & playback through single user interface simultaneously with other compatible VMS through supplied PC Server & PC Client Software.

### 7.0 HARDWARE:

- A. The VMS server shall operate on 2<sup>nd</sup> generation Intel® Core i7 processor and 8 GB of Ram or approved equivalent.
- B. VMS server shall utilize windows 7" ultimate 64 bit operating system or windows based equivalent operating system. But it should not lesser than windows 7 ultimate.
- C. VMS server shall have internal DVD +RW
- D. VMS server shall have two DV1-D ports.

- E. VMS server shall have expansions of IP video channel capacity through a licensing without any modification in hardware.
- F. VMS server shall support multiple make/models of IP Camera and encoders including third party manufacturer.
- G. VMS server shall also support audio recording in addition to third party manufacturer's audio recording.
- H. VMS server shall support recording the internal storage (Built-in)server with additional storage utilize SCSI attached HDD1 storage.
- I. VMS server shall capable of continuous scheduled alarm/event and motion recording, pre and post alarm recording also be available and full programmable on per channel basis.
- J. The VMS system shall allow archival of video data to computers or SAN storage devices over a network connection with optional compatible archive utility. The archival schedule shall be either automatic at user defined intervals or manual and shall be configurable per connected per connected camera.
- K. VMS shall indicate system performance.
- L. RAIDS or NAS storage media built in an external shall be used. Minimum 48 TB built in shall be required. Manufacture should submit the data storage calculation prior to bidding.
- M. System shall have 6, 3.5 inch drive and optical DVR ± RW.
- N. System shall have PC1-E slots x 16 and PC1-E x 4.
- O. Auxiliary interfaces shall be USB 2.0 and USB 3.0 ports.
- P. 100 to 240 VAC 50/60 Hz, Auto ranging.
- Q. The maximum frame per second for recording or storage shall be 15 fps. Supplier shall be responsible for better resolution and good result.
- R. The resolution or frame size is not less than 1280 x 720.
- S. System should have recording capacity for 90 days recording of all cameras at 24 hours a day.

## 8.0 CLIENT SOFTWARE

- A. The IP VMS shall be capable running client application.
- B. The minimum client hardware configuration shall be Intel core I7 with required graphic cards.
- C. The memory shall be 4 GB or high.
- D. The system shall have optical drive like DVR +.
- E. The optical system shall be windows based XP professional or as engineer approved.
- F. The system shall have required accessories like connecting cables, programming, hardware for rack mounting recovery disc etc.
- G. The client software shall include all licenses for any additional third party cameras. No additional license cost shall be barred by client.
- H. The client software shall have capable for interface the multiple DVR or NVR platforms.
- I. The client system & software shall support minimum 20 to 25 cameras matrix on required fps resolution. It is the suppliers' responsibility to provide the better resolution and performance.

- J. The client system & software shall provide live video review and record video view with at least 1, 5, 15, 30, 60 or 90 minutes.
- K. The client system & software shall capable to selectable in-video PT2 control or dashboard style control.
- L. The system & software shall capable for video export to any accessible media like HDD, DVD or network storage.
- M. The system shall have alarm pop-up featured and playback active alarm. It shall have on motion detection.
- N. The system & software shall have capable for matrix functionality whereby cameras sequences creating on monitor.

**ELECTRICAL:**

Input Voltage            100-240 VAC, 50Hz, auto ranging

**Note:**

**The active switches POE type is the responsibility of Client IT personal.  
Passive equipments CAT 6 cable and Patch panel has been covered in  
Telecom BOQ.**

**SECTION - E - 12**  
**ADDRESSABLE FIRE ALARM SYSTEM**

**1. SCOPE OF WORK**

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete Addressable Fire Alarm system as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and positions of the system.

The Fire Alarm system with accessories shall also comply with the General Specifications for Electrical Works, Section E- 1 and with other relevant provisions of the Tender document.

**2. STANDARDS**

The latest editions of the following standards / codes shall be applicable for the materials covered within the scope of this specification:

BS/EN 5839/54

NFPA 72

Any other standard referred to in above standards or these specifications.

**3. OPERATION**

The Fire Alarm System shall be pre-signal non-coded type complete with battery standby power.

At locations indicated in the drawings the break glass type fire alarm stations and automatic detectors shall be installed. In case of any Fire, the manual station shall be operated by pulling down the handle or breaking glass. The actuation of this station shall cause an audio as well as visual alarm at the fire alarm control and indication unit, duly indicating the location of the respective station/zone.

An authorized person shall immediately visit the affected area and if after investigating, it is deemed necessary, alarm in the whole building shall be initiated from either the alarm switch located beside the fire alarm control panel by inserting a special key or the actuation of any indication at the Main Fire Alarm Control Panel. The general alarm shall be initiated by an authorized person after inspecting the affected location.

Circuit shall be so arranged that an open circuit in an initiating or indicating loop shall cause the individual zone and common trouble indication at the fire alarm control panel.

**4. MATERIAL**

**4.1 Conduit and Conduit Accessories**

The specifications for conduit and conduit accessories shall be same as given for electrical conduit in Section E - 5 of these specifications.

**4.2 Fire Alarm Cable**

Fire Alarm Cable shall be 2 core 1.5 sq mm shielded twisted pair, fire resistant, PVC insulated, 250/440 volts grade cable to be laid in concealed PVC conduit. It shall have fire rating of 2 hours.

**4.3 Power Supply**

The supply and operating voltages shall be 220 volts, 50 c/s and 24 volts D.C. respectively. The control stations shall be provided with sufficient capacity nickel cadmium battery with charger to operate the complete system for the least 15 hours in case of mains failure.

**4.4 Fire Alarm Control and Indication Unit**

The fire alarm control and indication unit shall be a Solid State Modular Unit consisting of the following Modules; suitable number of modules shall be used to provide facility for building. There shall be fire alarm control panel of 2 loop located at Faculty block of both Natural Sciences and Media Sciences, Admin Block's main entrance and 1 loop panel located at Library and Student Welfare Center. It shall not be possible to remove the key without turning the key to its normal position, thus resetting the alarm contacts.

**i. Loop Module**

Loop Module shall have multiple of supervised initiating circuit with a trouble and an Alarm Lamp for each loop. Detection circuit wiring shall be two wire Class `A' and shall power all Detectors (Relay outputs and) voltage output for each zone alarm and voltage output for each zone trouble shall be provided.

**ii. Audible Expander Modules**

Audible Expander Modules shall provide for supervised control circuit for polarized alarm signaling devices loop activated lamp shall be provided for each loop to aid on system testing and trouble- shooting

**iii. Power Module**

Power Module shall supply the necessary power for the loop module and all Detectors (and shall contain a Battery Charger to charge the batteries) An AC power to Lamp shall be provided to indicate the normal condition of the panel. Individual supervisory lamps shall be provided for AC power failure indication, ground fault detection, and low battery. All controls shall be behind a key-locked door to prevent unauthorized operation. Two supervised control circuits for audible signaling shall be provided as part of this module. Common trouble and common alarm relay and logic outputs shall be provided. The panel cover shall be key-locked to prevent unauthorized access.

**4.5 Manual Break Glass Station**



The break-glass manual station shall be operated by pulling down on the handle. When operated, the handle shall remain down with the pre-signal alarm contacts closed until the station is reset. The general alarm contacts shall remain open until after investigation. The general alarm switch shall be operated by an authorized person with a special key.

#### 4.6 Audible Signal Unit

Fire alarm (bell) shall be red color surface mounted installed where indicated on the drawings. Sound intensity shall be such that an audible signal will be heard clearly throughout the structure when all the bell ring. The bell shall be connected in multiple cross loop conductors

##### Manual Functions

At any time, even without an alarm condition on an indicating circuit, the operator shall provide the following manual capabilities in the FACP by means of switches located behind a key-locked cover:

- a. In case of fire if a general evacuation is needed all bells shall sound. These signals can be initiated from the main panel and secondary switch at manual fire alarm initiating device (break glass unit).
- b. Silence the local audible signal. This shall also cause the LED(s) to cease flashing and to be continuously 'ON'.
- c. Silence the alarm signals.
- d. Reset the FACP, after all initiating devices have been restored to normal.
- e. Disconnect any individual initiating or indicating circuit from the alarm sequence. This action shall light a disconnect LED and cause a trouble condition.
- f. Perform a complete operational test of the system microprocessor with a visual indication of satisfactory communication with each board.
- g. Test all panel LEDs for proper operation without causing a change in the condition on any zone.

All initiating and indicating device circuits. All plug-in circuit board shall have proper board type in the position. System that use electrical continuity to supervise the presence of plug boards, but that do not assure that board position have been exchanged, shall provide equivalent means for specified supervision, beyond that provided by the locked cover.

#### 4.9 Function of Addressable Fire Alarm Control Panel (FACP)

**i. Design**

The FACP shall be solid state, modular design with integral static protection. All indicating lamps shall be long-life, low maintenance solid state light emitting diodes (LED).

**ii. Enclosure**

The FACP enclosure shall be semi-flush mounted. The enclosure shall be hinged from the left and the cover shall have clear windows and locking mechanism to keep the system operating and status switches from being tampered keys shall be made available to fire department and other authorized operating personnel. Finish shall be "FIRE ALARM RED" and "BLACK".

**iii. Loops & Identification**

All controls shall be labeled, all loop locations shall be identified, and the FACP shall be provided with a set of permanently mounted operating instructions, to avoid confusion. Loop location identification shall be as approved by the Engineer In charge and contain up to three lines of text with 1/8" minimum character heights.

**iv. Components of Fire Alarm Control Panel**

The FACP shall include as minimum following:

- a. All hardware and software to allow the panel configuration and operation to be changed at the panel. System that require off-site programming are not acceptable.

The memory data for panel configuration and operation shall reside in non-volatile, memory provided by battery-backed RAM. Removal of the board shall not cause loss of memory contents.

Switches for panel setup, set reset, manual, evacuation alarm, silence and acknowledge. Individual supervisory LEDs shall be provided for power, run, alarm, trouble, disconnect, low battery and ground fault.

- b. Indicating Loops: 1 and 2 loop indicating circuits shall be provided. Each circuit shall provide power for polarized alarm signaling devices. A red LED to indicate the energized state of the circuit and a yellow LED to indicate a trouble condition shall be provided for each circuit. A disconnect switch for each circuit shall be provided to allow the FACP to be tested with sounding alarm signals. When disconnected, the FACP shall indicate both trouble condition and disconnect.

**v. Manual Functions**

At any time, even without an alarm condition on an indicating circuit, the operator shall provide the following manual capabilities in the FACP by means of switches located behind a

key-locked cover:

- a. In case of fire if a general evacuation is needed all bells shall sound. These signals can be initiated from the main panel and secondary switch at manual fire alarm initiating device (break glass unit).
- b. Silence the local audible signal. This shall also cause the LED(s) to cease flashing and to be continuously 'ON'.
- c. Silence the alarm signals.
- d. Reset the FACP, after all initiating devices have been restored to normal.
- e. Disconnect any individual initiating or indicating circuit from the alarm sequence. This action shall light a disconnect LED and cause a trouble condition.
- f. Perform a complete operational test of the system microprocessor with a visual indication of satisfactory communication with each board.
- g. Test all panel LEDs for proper operation without causing a change in the condition on any zone.

**vi. System Supervision**

- a. Upon application of primary power, or reapplication following power failure, the FACP shall automatically be in a normal supervisory condition.
- b. In the normal supervisory condition, a green "POWER" LED shall be illuminated, indicating the presence of primary power.
- c. A green "RUN" LED shall be illuminated indicating that the microprocessor is communicating with the system and the memory contents are satisfactory.
- d. All initiating and indicating device circuits shall be electrically supervised.

All plug-in circuit board shall have proper board type in the position. System that use electrical continuity to supervise the presence of plug boards, but that do not assure that board position have been exchanged, shall provide equivalent means for specified supervision, beyond that provided by the locked cover.

**4.10 Shop Drawings / Technical Specifications**

Prior to installation of any equipment, the Contractor shall submit for approval, shop drawings including riser and terminal wiring diagrams and specifications data sheets. Submittals indicating typical one line

riser and typical specification data sheets only will not be acceptable.

The Contractor shall review the total system point to point wiring layout to assure that the correct number and type of wire and conduit sizes are installed.

Upon completion, the Contractor shall provide detailed written operation instructions and three sets of "as built" drawings including plan, layout, conduit runs and wiring diagrams as finally installed.

**4.11 Addressable Audible Signal Unit:**

Fire alarm sounder with strobe shall be red color surface mounted installed where indicated on the drawings. Sound intensity shall be such that an audible signal will be heard clearly throughout the structure when the entire bells ring. The bell shall be connected in multiple cross loop conductors.

**4.12 Addressable Smoke Detector:**

The Smoke Detector is optical type and shall be connected to the specific loop. Base shall be provided with detector.

**4.13 Addressable Heat Detector:**

The Heat Detector is connected to the specific loop. Base shall be provided with detector.

**4.11 Test**

Upon completion and at such time as the Engineer incharge may direct, the Contractor shall conduct a total system test where line supervision and each device shall be tested. All the tests shall demonstrate that the system meets the tests shall operating requirements of this specification, that individual conductors of all circuits are free of grounds, shorts and breaks, and that no grounds exist between any piece of equipment in the control unit and the cabinet. All final connections, testing, adjusting and calibrating shall be made under the direct supervision of a factory trained technician of the system supplier.

**4.12 Fire Alarm Installation**

The Fire alarm system shall be installed as mentioned in the drawings. The system shall be connected, tested and commissioned as per manufacturer's instructions and in the presence of Engineer Incharge. The wall recessed mounting Fire alarm manual stations shall be installed at a height of 4.5' feet above finished floor level. The connections of the appropriate Contactors of the Fire alarm system shall be made as per manufacturer's instructions.

The mounting height of the sounder shall be above the false ceiling or 7' from F.F. level when false ceiling is not comes. The conduit and wiring of the Fire alarm system shall be as per installation instructions for conduits and wirings given in the relevant section of these specifications. The Fire alarm system conduit shall be laid 15 cms (6") from the electrical conduits and cross the electrical conduit at 90 degree only. The Fire alarm system conduit shall be marked with red colour at terminations in

order to distinguish it from other conduit system.

## SECTION - E – 13 ACCESS CONTROL SYSTEM

### 1. STANDARDS

Materials and workmanship shall conform to the latest issue of all industry standards, publications, or regulations referenced in this section and with the following references as applicable.

NFPA 70 – National Electrical Code  
UL294 – Standard for Access Control Systems  
NFPA 72 – National Fire Alarm Code  
NFPA 101 - Life Safety Code.

### 2. SYSTEM DESCRIPTION

The System shall be a modular and network capable access control system. The System shall have the ability of handling controlled access with various reader technologies supported simultaneously, alarm monitoring with text and graphics based annunciation. The system control at the central computer location shall be under a single software program control, shall provide full integration of all components, and shall be alterable at any time, depending upon the facility requirements. Reconfiguration shall be accomplished on-line through system programming, without hardware changes. This shall be integrated with BMS. Access Control Systems shall be located as specified in drawings.

The system shall support both manual and automatic responses to alarms entering the system. Each alarm shall be capable of initiating a number of different actions, activation of remote devices and door control.

**Access control functions shall include Enterprise level Time attendance Software, validation based on time of day, day of week, holiday scheduling, automatic or manual retrieval of cardholder photographs, and access validation based on positive verification of card, card/PIN, and PIN.**

The system programming shall be user-friendly Windows environment (use conventional "Title Bar", "Menu Bar", "Tool Bar" and "Status Bar") and allow mouse control of key functions. The programming shall be MENU driven and include on-line "Documentation", "Help" or "Tutorial" information. The software shall utilize combo boxes for previously entered system-required data where applicable.

The method of communication from remote locations to the central components shall be transparent to the user.

After installation, the OWNER shall be able to perform hardware configuration changes as desired without the services of the MANUFACTURER.

Equipment repair shall be able to be accomplished on site, by module replacement, utilizing spare components.

All controller components shall utilize "Distributed-Processing" concepts. The distributed processing shall include the ability to down-load operating parameters to any field panel, thus allowing the field panel to provide full operating functions independent of any other system component.

The system shall be capable of utilizing the existing LAN / WAN connecting the buildings or a dedicated security Ethernet network for Controller and Client communications.

Manufacturer: The access control system shall be from a single-source manufacturer that specializes in access control and intrusion detection systems with a minimum of 20 years experience.

Installer: Company specializing in access control and intrusion detection systems with a minimum of three years experience on systems of similar size and scope. Technicians working on project must have been certified on the hardware and software used for this project.

### 3. SUBMITTALS

#### A. Manufacturer's Data:

##### 1. Submit three (3) copies of:

- a. Product Data Sheets
- b. Installation Instructions

##### 2. Authorized Dealer Certificate and Certified Training Certificates of installers who will be working on this project.

#### B. Shop Drawings

Submit three (3) copies and digitally in AutoCad or later format on a CD (3 copies), shop drawings, including:

- a. Layout of equipment on supplied AutoCad drawings.
- b. Security Console elevation drawings.
- c. Field Controller equipment location wall layouts, including size requirements.
- d. Detailed wiring diagrams of Field Controllers, Door Details, and head-end devices.
- e. Load calculations of all security equipment for proper sizing of electrical provided by the customer and standby emergency generator circuits.

#### C. As-Built Drawings

Update Shop Drawings to create final As-Built Drawings. Submit 3 copies and digitally in AutoCad 14 or later format on a CD (3 copies).

#### D. Operation and maintenance manuals

Operation Data: Include three (3) copies of the software Administrator

and Operator Manuals.

E. UPS

The UPS (Uninterruptible Power Supply) for the Server shall provide for 20 minutes of continued operation in the event of an AC Power Failure.

F. Control Panel Specifications

The control panel shall incorporate microprocessor-based, digital technology, using high speed processing for maximum reliability.

G. Distributed Intelligence

1. The system shall use distributed intelligence architecture, with controllers operating independently of one another.

H. Stand Alone Operation

1. All database information required for stand-alone operation shall be stored at the control panel level. All decision-making shall be performed at the control panel, eliminating the need for degraded mode operation.

2. Proprietary software programs and control logic information used to coordinate and drive system hardware shall be stored in Flash Downloadable Read Only Memory.

#### 4. **HARDWARE REQUIREMENTS**

A. Controllers

There controllers shall be: access control 2 door type; alarm monitoring (16 supervised inputs); and relay control with the addition of REB8 relay expansion boards and. Each controller shall have the following common features.

B. Controller Board

The controller board shall be microprocessor based, incorporating Flash ROM (firmware) downloadable from the Host Computer, RAM (User Information, System Setups, Event Transaction Buffer) and a Clock/Calendar. The ROM shall be modularly upgradeable in the field for enhancements to system features. All powered connections to the controller board shall be protected by fuses. All wiring connections to the controller board shall be to "Phoenix" type screw terminals. Each door connection shall consist of terminals for two readers, one 10 Amp rated Form C dry output relay for lock control, and one input for monitoring a status switch, a request-to-exit device, and a tamper switch. There shall be status indicator lights for active relays, as well as diagnostic indicator lights to aid in system troubleshooting. There shall be dedicated alarm output relay/s for external reporting of the following conditions: Alarm; Duress; Tamper; and Trouble.



C. Enclosure

The controller enclosure shall be a NEMA style metal cabinet designed for surface mounting. It shall have a tampered, removable hinged door with a high security key lock. It shall have conduit knockouts to allow from 25mm conduit to be used for wire entry into the cabinet.

D. Internal Power Supply

The controller shall have an internal power supply that will accept 50 Hz/ 220 - 240 VAC. The primary side of the power supply shall be protected with a fuse. The power supply shall provide 28 VDC power to the controller board, internal battery charger, selected card readers, and reader interface boards.

E. Standby Battery

The controller shall have an internal standby battery that is capable of running the system during AC power interruptions. It shall be recharged by a charging circuit incorporated into the controller board.

F. Alarm Inputs

The controller shall be capable of accepting up to 32 additional supervised alarm inputs, in increments of eight (8). The sensitivity of the line supervision shall be 2% AA Standard. The alarm expansion boards shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable. This option shall be limited to 16 additional supervised alarm inputs for the 16 zone alarm input controller.

G. Intelligent Reader Interface

The control panels shall utilize an intelligent reader interface to communicate with card readers of various types. The interface shall be microprocessor based and allow data formats including ABA magnetic stripe, Proximity, Bar Code, Touch Memory, RF and Biometric. The interface shall utilize a digitizing algorithm, which will convert the card data to a unique number, thus, eliminating the need for facility codes. A single interface shall support both entrance and exit readers with keypads associated with each door. The interface shall be U.L. Listed to U.L.294. The reader interface shall be included as standard in all Scramble Pads.

## 5. CONTROLLER FIRMWARE

A. General Features

1. The software for the controller shall reside in Flash ROM (firmware) and be located on a plug removable module on the controller board to facilitate easy field upgradability of the features. All of the necessary software for a fully functional System is located in the controller.
  - a. 3 - 15 digit keypad Code's
  - b. Duress digit for keypad Code's

- c. 150 Time Zones for access restriction and automatic event control
- d. 128 Access Zones for access management
- e. 256 Control Zones for alarm and relay management
- f. Assigned to 1 – 4 Holiday Schedules.
- g. Automatic daylight savings time clock adjustment
- h. 27 different functions for Code's and cards, e.g. access, unlock, re-lock, alarm mask,
- i. relay control
- j. Add user records
- k. Tag users for annunciation at host computer
- l. 4,000 Users
- m. 1500 event, 1500 alarm transaction buffer

#### B. Access Control Features

1. The controller shall include the following access control features at a minimum.
  - a. Restrict access by: time of day; day of week; door; holiday
  - b. Momentary Access of door up to 8100 seconds
  - c. Extended Access for User Definable Momentary Access duration (requires ScramblePad). ScramblePad will display time remaining on the minute, and annunciate at the defined "Warning Time"
  - d. Special Needs Time Extension to provide additional time for Momentary Access and Door Open Too Long for selected people.
  - e. Unlock/Re-lock of door by CODE, card or Time Zone
  - f. Door status monitoring shall allow for: door forced monitoring; door-open-too-long monitoring; door-open-too-long while door is unlocked; auto-re-lock of door when opened or closed
  - g. Request-to-exit masks alarm and/or unlocks door
2. 2 person requirement by door. A user can be defined as Normal, A/B Rule A, A/B Rule B, Executive Override. Can be disabled by Time Zone.
3. 63 Pass back Zones. Can be disabled by Time Zone. A User can be designated with Pass back Executive Override.
4. Use Count limits on users
  - a. Absentee Rule limits on users
  - b. Temporary Day limits on users
  - c. Occupancy Counting / Minimum & Maximum limits per Passback Zone
  - d. Deadman CODE / Timer
  - e. Threat Levels – 99 Levels may be defined. Based on the Level in effect for the facility, selected readers may be disabled, dual readers in Card/Code Only during Time Zone can require dual, and selected User's Credentials can be disabled.

### C. Alarm Management Features

1. The controller shall include the following alarm management features at a minimum.
  - a. Momentarily mask alarm by CODE and/or card
  - b. Mask/unmask alarm by CODE and/or card or by Time Zone
  - c. Alarm device supervised while masked
  - d. Tamper switch on alarm device monitored while masked
  - e. Tamper Input may be configured to operate as a “Latch Monitor” with the appropriate door lock hardware.
  - f. Entry/Exit delay per alarm input
  - g. Alarm input triggers relay/s

## 6. CARD READER/KEYPAD SPECIFICATIONS

### Readers

1. The controllers shall accept all of the following reader technologies concurrently Proximity with Biometrics Fingerprint. The readers can be used for access control, alarm management, and/or relay control and shall be capable of being used alone (keypad only, card only) and any other reader technology may be combined to operate as a dual technology reader where two valid IDs (PIN and card) are required.

## PART 1 - EXECUTION

### 3.1 INSTALLATION

- A. Install system in accordance with manufacturer's instructions.
- B. Install wiring for detection and signal circuit conductors in conduit. Use 22 AWG minimum size conductors.
- C. Make conduit and wiring connections to existing door hardware devices as required.

### 3.2 TRAINING

- A. The two designated System Administrators shall attend the 3 Day Factory Velocity User Class.
- B. The Dealer shall coordinate with the System Administrators for two 8 hour Operator training sessions on the Operational System to be conducted on-site on the actual running system.

### 3.3 FIELD QUALITY CONTROL

- A. Test in accordance with system manufacturer guide lines or by engineer incharge.

## **SECTION-E-14**

### **UNINTERRUPTIBLE POWER SUPPLY (UPS)**

#### **1.0 SUMMARY**

This Section includes 400V, 50 Hz, three-phase in, three-phase out, on-line, double-conversion, static-type, UPS installations complete with transient voltage surge suppression, input harmonics reduction, rectifier-charger, battery, battery disconnect device, inverter, static bypass transfer switch, output isolation transformer, battery monitoring.

#### **2.0 SUBMITTALS**

- i. Product Data: For each UPS component indicated.

- ii. Shop Drawings: Detail assemblies of equipment indicating dimensions, weights, components, and location and identification of each field connection. Show access, workspace, and clearance requirements; details of control panels; and battery arrangement.
- iii. Factory test reports.
- iv. Field quality-control test reports.
- v. Operation and maintenance data.
- vi. Warranties.

**3.0 QUALITY ASSURANCE**

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 and for compliance with the following:

UL 1778.

Retain subparagraph below if UPS components for this Project are installed in computer rooms.

Suitable for installation in computer rooms according to NFPA 75.

**4.0 WARRANTY**

Special Battery Warranties: Specified form in which manufacturer and Installer agree to repair or replace UPS system storage batteries that fail in materials or workmanship within specified warranty period.

Warranted Cycle Life for Valve-Regulated, Lead-Acid Batteries: Equal to or greater than that represented in manufacturer's published table, including figures corresponding to the following, based on annual average battery temperature of 35 deg. C:

Discharge Rate	Discharge Duration	Discharge End Voltage	Cycle Life
8 hours	8 hours	1.67	6 cycles
30 minutes	30 minutes	1.67	20 cycles
15 minutes	45 seconds	1.67	120 cycles

1. Warranted Cycle Life for Premium Valve-Regulated, Lead-Acid Batteries: Equal to or greater than that represented in manufacturer's published table, including figures corresponding to the following, based on annual average battery temperature of 35 deg C:

Discharge Rate	Discharge Duration	Discharge End Voltage	Cycle Life
8 hours	8 hours	1.67	40 cycles
30 minutes	30 minutes	1.67	125 cycles
15 minutes	1.5 minutes	1.67	750 cycles

See Evaluations.

Special UPS Warranties: Specified form in which manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within special warranty period.

Manufacturers will honor either of two options in subparagraph below. Initial cost increases with length of warranty.

Special Warranty Period: Three years from date of Substantial Completion.

## **5.0 PRODUCTS**

### **5.1 MANUFACTURERS**

Edit this Article with other Part 2 articles in which manufacturers are named. See Division 1 Section "Product Requirements" for an explanation of the terms "Available Manufacturers" and "Manufacturers" and the effect these terms have on "Comparable Product" and "Product Substitution" requirements.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### **5.2 PERFORMANCE DESCRIPTION**

Automatic operation includes the following:

1. Normal Conditions: Supply the load with ac power flowing from the normal ac power input terminals, through the rectifier-charger and inverter, with the battery connected in parallel with the rectifier-charger output.
2. Abnormal Supply Conditions: If normal ac supply deviates from specified and adjustable voltage, voltage waveform, or frequency limits, the battery supplies energy to maintain constant, regulated inverter ac power output to the load without switching or disturbance.
3. If normal power fails, energy supplied by the battery through the inverter continues supply-regulated ac power to the load without switching or disturbance.
4. When power is restored at the normal supply terminals of the system, controls automatically synchronize the inverter with the external source before transferring the load. The rectifier-charger then supplies power to the load through the inverter and simultaneously recharges the battery.
5. If the battery becomes discharged and normal supply is available, the rectifier-charger charges the battery. On reaching full charge, the rectifier-charger automatically shifts to float-charge mode.
6. If any element of the UPS system fails and power is available at the normal supply terminals of the system, the static bypass transfer switch switches the load to the normal ac supply circuit without disturbance or interruption.
7. If a fault occurs in the system supplied by the UPS, and current flows in excess of the overload rating of the UPS system, the static bypass transfer switch operates to bypass the fault current to the normal ac supply circuit for fault clearing.

8. When the fault has cleared, the static bypass transfer switch returns the load to the UPS system.
9. If the battery is disconnected, the UPS continues to supply power to the load with no degradation of its regulation of voltage and frequency of the output bus.
10. Battery backup time shall be 15 minutes at full load.

Manual operation includes the following:

1. Turning the inverter off causes the static bypass transfer switch to transfer the load directly to the normal ac supply circuit without disturbance or interruption.
2. Turning the inverter on causes the static bypass transfer switch to transfer the load to the inverter.

### 5.3 SERVICE CONDITIONS

Environmental Conditions: The UPS shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability, except battery performance.

1. Ambient Temperature for Electronic Components: 5 to 45 deg. C.
2. Ambient Temperature for Battery: 0 to 35 deg. C.
3. Relative Humidity: 0 to 95 percent, no condensing.

### 5.4 PERFORMANCE REQUIREMENTS

The UPS shall perform as specified in this Article while supplying rated full-load current, composed of any combination of linear and nonlinear load, up to 100 percent nonlinear load with a load crest factor of 3.0, under the following conditions or combinations of the following conditions:

- i. Inverter is switched to battery source.
- ii. Steady-state ac input voltage deviates up to plus or minus 10 percent from nominal voltage.
- iii. Steady-state input frequency deviates up to plus or minus 5 percent from nominal frequency.
- iv. THD of input voltage is 15 percent or more with a minimum crest factor of 3.0, and the largest single harmonic component is a minimum of 5 percent of the fundamental value.
- v. Minimum Duration of Supply: If battery is sole energy source supplying rated full UPS load current at 80 percent power factor for a period of 15 minutes.

Input Voltage Tolerance: System steady-state and transient output performance remains within specified tolerances when steady-state ac input voltage varies plus 10, minus 15 percent from nominal voltage.

Maximum Energizing Inrush Current: Six to Eight times the full-load current.

Maximum AC Output-Voltage Regulation for Loads up to 50 Percent Unbalanced: Plus or minus 2 percent over the full range of battery

voltage.

Output Frequency: 50 Hz, plus or minus 0.5 percent over the full range of input voltage, load, and battery voltage.

Limitation of harmonic distortion of input current to the UPS shall be as follows:

Maximum Harmonic Content of Output-Voltage Waveform: 5 percent RMS total and 3 percent RMS for any single harmonic, for rated full load with THD up to 50 percent, with a load crest factor of 3.0.

Minimum Overload Capacity of UPS at Rated Voltage: 125 percent of rated full load for 10 minutes, and 150 percent for 30 seconds in all operating modes.

Maximum Output-Voltage Transient Excursions from Rated Value: For the following instantaneous load changes, stated as percentages of rated full UPS load, voltage shall remain within stated percentages of rated value and recover to, and remain within, plus or minus 2 percent of that value within 100 ms:

1. 50 Percent: Plus or minus 5 percent.
2. 100 Percent: Plus or minus 5 percent.
3. Loss of AC Input Power: Plus or minus 1 percent.
4. Restoration of AC Input Power: Plus or minus 1 percent.

Input Power Factor: A minimum of 0.95 lagging when supply voltage and current are at nominal rated values and the UPS is supplying rated full-load current.

EMI Emissions: Comply with FCC Rules and Regulations, and with 47 CFR 15 for Class A equipment.

## **5.5 UPS SYSTEMS**

Electronic Equipment: Solid-state devices using hermetically sealed, semiconductor elements. Devices include rectifier-charger, inverter, static bypass transfer switch, and system controls.

Enclosures: Comply with NEMA 250, Type 1, unless otherwise indicated. Control Assemblies: Mount on modular plug-ins, readily accessible for maintenance.

Surge Suppression: Protect internal UPS components from surges that enter at each ac power input connection including main disconnect switch and static bypass transfer switch. Protect rectifier-charger, inverter, controls, and output components.

Output Circuit Neutral Bus, Conductor, and Terminal Opacity: Rated phase current times a multiple of 1.73, minimum.

## **5.6 RECTIFIER-CHARGER**

Capacity: Adequate to supply the inverter during rated full output load



conditions and simultaneously recharge the battery from fully discharged condition to 95 percent of full charge within 10 times the rated discharge time for duration of supply under battery power at full load.

Output Ripple: Limited by output filtration to less than 0.5 percent of rated current, peak to peak.

Rectifier-Charger Control Circuits: Immune to frequency variations within rated frequency ranges of normal and emergency power sources.

Response Time: Field adjustable for maximum compatibility with local generator-set power source.

Battery Float-Charging Conditions: Comply with battery manufacturer's written instructions for battery terminal voltage and charging current required for maximum battery life.

### **5.7 INVERTER**

Description: Pulse-width modulated, with sinusoidal output.

### **5.8 STATIC BYPASS TRANSFER SWITCH**

Description: Solid-state switching device providing uninterrupted transfer. A contactor or electrically operated circuit breaker automatically provides electrical isolation for the switch.

Switch Rating: Continuous duty at the rated full UPS load current, minimum.

### **5.9 BATTERY**

Description: Valve-regulated, recombinant, lead-calcium units, factory assembled in an isolated compartment of UPS cabinet and complete with battery disconnect switch.

Description: Valve-regulated, premium, heavy-duty, recombinant, lead-calcium units, and factory assembled in an isolated compartment or in a separate matching cabinet, complete with battery disconnect switch.

### **5.10 CONTROLS AND INDICATIONS**

Description: Group displays, indications, and basic system controls on a common control panel on front of UPS enclosure.

Minimum displays, indicating devices, and controls include those in lists below. Provide sensors, transducers, terminals, relays, and wiring required to support listed items. Alarms include audible signals and visual displays.

Indications:

- Quantitative indications shall include the following:

- i. Input voltage, each phase, line to line.
  - ii. Input current, each phase, line to line.
  - iii. Bypass input voltage, each phase, line to line.
  - iv. Bypass input frequency.
  - v. System output voltage, each phase, line to line.
  - vi. System output current, each phase.
  - vii. System output frequency.
  - viii. DC bus voltage.
  - ix. Battery current and direction (charge/discharge).
  - x. Elapsed time discharging battery.
- Basic status condition indications shall include the following:
    - i. Normal operation.
    - ii. Load-on bypass.
    - iii. Load-on battery.
    - iv. Inverter off.
    - v. Alarm condition.
  - Alarm indications shall include the following:
    - i. Bypass ac input overvoltage or under voltage.
    - ii. Bypass ac input over frequency or under frequency.
    - iii. Bypass ac input and inverter out of synchronization.
    - iv. Bypass ac input wrong-phase rotation.
    - v. Bypass ac input single-phase condition.
    - vi. Bypass ac input filter fuse blown.
    - vii. Internal frequency standard in use.
    - viii. Battery system alarm.
    - ix. Control power failure.
    - x. Fan failure.
    - xi. UPS overload.
    - xii. Battery-charging control faulty.
    - xiii. Input overvoltage or under voltage.
    - xiv. Input transformer over temperature.
    - xv. Input circuit breaker tripped.
    - xvi. Input wrong-phase rotation.
    - xvii. Input single-phase condition.
    - xviii. Approaching end of battery operation.
    - xix. Battery under voltage shutdown.
    - xx. Maximum battery voltage.
    - xxi. Inverter fuse blown.
    - xxii. Inverter transformer over temperature.
    - xxiii. Inverter over temperature.
    - xxiv. Static bypass transfer switch over temperature.
    - xxv. Inverter power supply fault.
    - xxvi. Inverter transistors out of saturation.
    - xxvii. Identification of faulty inverter section/leg.
    - xxviii. Inverter output overvoltage or under voltage.
    - xxix. UPS overload shutdown.
    - xxx. Inverter current sensor fault.
    - xxxi. Inverter output contactor open.
    - xxxii. Inverter current limit.

Controls shall include the following:

- i. Inverter on-off.
- ii. UPS start.
- iii. Battery test.
- iv. Alarm silence/reset.
- v. Output-voltage adjustment.

Emergency Power off Switch: Capable of local operation and operation by means of activation by external dry contacts.

### **5.11 OUTPUT ISOLATION TRANSFORMER**

Description: nit with low forward transfer impedance up to 3 kHz, minimum. Include the following features:

Comply with applicable portions of UL 1561, including requirements for nonlinear load current-handling capability for a suitable K-factor.

- i. Output Impedance at Fundamental Frequency: Between 3 and 4 percent.
- ii. Regulation: 5 percent, maximum, at rated nonlinear load current.
- iii. Full-Load Efficiency at Rated Nonlinear Load Current: 96 percent, minimum.
- iv. Electrostatic Shielding of Windings: Independent for each winding.
- v. Coil Leads: Physically arranged for minimum inter lead capacitance.
- vi. Shield Grounding Terminal: Separately mounted; labeled "Shield Ground."
- vii. Capacitive Coupling between Primary and Secondary: 33 Pico farads, maximum, over a frequency range of 20 Hz to 1 MHz

### **5.12 BASIC BATTERY MONITORING**

Battery Ground-Fault Detector: Initiates alarm when resistance to ground of positive or negative bus of battery is less than 5000 ohms. Annunciation of Alarms: At UPS control panel.

### **5.13 BATTERY-CYCLE WARRANTY MONITORING**

Description: Electronic device, acceptable to battery manufacturer as a basis for warranty action, for monitoring of charge-discharge cycle history of batteries covered by cycle-life warranties.

Performance: Automatically measures and records each discharge event, classifies it according to duration category, and totals discharges according to warranty criteria, displaying remaining warranted battery life on front panel display.

### **5.14 SOURCE QUALITY CONTROL**

Factory test complete UPS system before shipment. Use simulated battery testing. Include the following:

- i. Test and demonstration of all functions, controls, indicators, sensors, and protective devices.
- ii. Full-load test.
- iii. Transient-load response test.
- iv. Overload test.
- v. Power failure test.  
Report test results.

## 6.0 INSTALLATION

Retain first paragraph below if required. Coordinate with Drawings.  
Install system components on 100mm high concrete bases.  
Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams, unless otherwise indicated.

See Evaluations for discussion of grounding for separately derived systems created by isolation transformers. Coordinate this Article with Drawings.

Separately Derived Systems: If not part of a listed power supply for a data-processing room, comply with NFPA 70 requirements for connecting to grounding electrodes and for bonding to metallic piping near isolation transformer.

Identify components and wiring according to relevant section of this specifications Equalize charging of battery cells according to manufacturer's written instructions. Record individual-cell voltages.

## 7.0 FIELD QUALITY CONTROL

Retain first paragraph below to require a factory-authorized service representative to perform, or assist Contractor with, field inspections, tests, and adjustments. Retain one of two options to suit Project; delete both to require only an inspection before field testing.

Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust equipment installation including connections and to assist in field testing. Report results in writing.

Electrical Tests and Inspections: Perform tests and inspections according to manufacturer's written instructions and as listed below to demonstrate condition and performance of each UPS component:

Inspect interiors of enclosures, including the following:

- Integrity of mechanical and electrical connections.
- Component type and labeling verification.
- Ratings of installed components.
  
- Test manual and automatic operational features and system protective and alarm functions.

Retest: Correct deficiencies and retest until specified requirements are met.  
Record of Tests and Inspections: Maintain and submit documentation of tests

and inspections, including references to manufacturers' written instructions and other test and inspection criteria. Include results of tests, inspections, and retests.

## **SECTION-E-15**

### **SELF CONTAINED EMERGENCY LIGHTS**

#### **1. SCOPE OF WORK**

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete light fixtures as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and positions of light fixtures.

The light fixtures with accessories shall also comply with the General Specifications for Electrical Works, Section - E-1 and with other relevant provisions of the Tender document.

#### **2. GENERAL**

The description of light fixtures in given Bill of Quantities, and stated on the drawings, and relevant material are described in this section. The determination of quality is based on certified photo-metric data covering the coefficient of utilization, light distribution curves, construction material, shape, finish, operation, etc.

The Contractor shall submit two samples of each and every light fixture specified and obtain approval of the Owner before purchasing. The quality and finishes of local make light fixtures (if mentioned in BOQ) shall be same as that of standard manufacturer.

All fixtures shall be finished in standard color schemes as mentioned in the manufacturer's catalogue for respective fixtures, unless specifically stated in the Specifications, Drawings or Bill of Quantities or directed by the Engineer.

#### **3. STANDARDS**

Lighting fixtures shall comply with Section E-1, Clause 3.

- BSEN 1838 Emergency Lighting

#### **4. EMERGENCY LIGHTS**

The emergency indoor lighting shall be operative during power breakdown and emergency situation, light fitting in several areas shall be

provided according to specifications.

All emergency lighting equipment utilized shall comply the standards as listed above. Emergency lighting shall be provided using self-contained 7W fluorescent type maintained for 3 hours duration battery inverter packs fitter to selected luminaries.

Along with emergency lighting 'Exit' signs shall be managed from the same lighting control modules as normal luminaries.

#### **5. EXIT & SAFETY Luminaire**

All Exit luminaires shall have pictogram legends as per DIN 4844/CEN TC 169, EN50171 or markings as per local civil defense requirements with viewing distance of 24 meters. The luminaire shall be built according to EN 60598. It's rating shall be 8W with 3 hours battery backup and IP 65 ingress protection.

Working Voltage: 220 – 240V AC/ 50/60 Hz

Viewing distance: 24 meters

Installation: It can be mounted on Wall/Side/ Ceiling

Accessories: It shall have over charge and discharge protection with charging LED and test button.

#### **6. EMERGENCY LUMINAIRE**

Luminaire shall be of fluorescent type

All luminaries shall meet following requirements:

Battery backup: 3 hr

Power rating: 7W

Supply voltage: 230V AC

Ingress Protection: IP 65

The luminaire shall comply with the requirements of EN60598

Electronic ballast shall comply with the requirements of EN60298/60294

EMC or EMI protection to EN55015

Ambient Temperature – 40 °C.

## **SECTION-E-16**

### **LIGHTNING PROTECTION SYSTEM**

#### **1.0 RELATED DOCUMENTS**

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **2.0 SUMMARY**

This Section includes lightning protection for buildings and associated structures and requirements for lightning protection system components.

#### **3.0 SYSTEM DESCRIPTION**

Protect relevant buildings from lightning by means of a system of conductors running on the roof top and effectively grounded, in accordance with relevant codes.

#### **4.0 SUBMITTALS**

General: Submit each item in this Article according to the Conditions of the Contract and Specification Sections-E-01. Product Data for each component specified. Include the following:

Shop Drawings detailing lightning protection system, include air terminal locations, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway and information on how concealment requirements will be met. Field inspection reports indicating compliance with specified requirements.

#### **5.0 QUALITY ASSURANCE**

Manufacturer and Installer Qualifications: Engage an experienced manufacturer who produces system components made of high quality materials as listed herein. Engage an installer who is listed or who is certified by the Lightning Protection Institute as a Master Installer. Life service of the materials used shall not be less than 30 years.

Lightning protection system shall conform to BS-6651 current edition.

#### **6.0 SEQUENCING AND SCHEDULING**

Coordinate installation of lightning protection with installation of other building systems and components, including supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

#### **7.0 LIGHTNING PROTECTION SYSTEM COMPONENTS:**

##### **Air Terminal**

Air terminal shall be taper pointed copper 1000 mm long, 15 mm dia. with base. The air terminal shall be similar to Furse Cat. No. RAD 215 or equal. Use all accessories for fixing as recommended by the manufacturer.

### **Horizontal Roof Conductor**

Roof conductor shall be bare copper tape of minimum 25 x 3 mm size similar to Furse TC-030 or equal. Horizontal bare conductor shall form a cage on the roof as per BS 6651. All fixing accessories shall be of high grade copper as manufactured by an approved specialist. Provide horizontal copper tape around the building at every 10 meter as per BS Standard 6651.

### **Bonding of Metal Structures**

All external metal structures above the roof surface and on building facade shall be effectively bonded to the lightning protection system as per BS 6651.

### **Down Conductors**

70sqmm PVC Copper down conductor in 50 mm GI pipe is embedded in structural columns as indicated on the drawings. It is connected to the mesh of horizontal protective conductors on roof. The down conductor is connected via test link located at the lowest level to foundation reinforcement steel for earthing the system as indicated on the drawings. Each down conductor is to be effectively Cad welded to the foundation steel using recommended method as per codes to form an earth termination network.

The whole of the earth termination network should have a combined resistance to earth not exceeding 10 Ohms without taking into account any bonding to other services. Provide additional rods, as required to achieve the required resistance without any additional cost.

## **8.0 EXECUTION EXAMINATION**

Examine surfaces, areas, and conditions, with Installer present, for compliance with installation tolerances and other conditions affecting performance of lightning protection. Do not proceed with installation until unsatisfactory conditions have been corrected.

## **9.0 INSTALLATION**

Install lightning protection as indicated, according to manufacturer's written instructions. Comply BS-6651. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops. Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components, except those above single-ply membrane roofing. Bond extremities of vertical metal bodies exceeding 60 feet (18m) in length to lightning protection components.

## **10.0 CORROSION PROTECTION**

Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such materials. Use conductors



with protective coatings where conditions would cause deterioration or corrosion of conductors.

#### **11.0 FIELD QUALITY CONTROL**

Periodic Inspections: Provide the services of a qualified inspector to perform periodic inspections during construction and at its completion.

**LIST OF APPROVED MANUFACTURER****\* All Equipment shall be procured from Principal Authorized agents / distributors / resellers**

The Bidder shall fill name of only one manufacturer for each equipment/material on which the tender 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 / Owner can ask the Bidder supply the equipment from any one of them.

At the evaluation stage if it is noted that any material offered by the bidder does not meet the specification requirements, the Engineer / Owner reserves the right to ask the bidder to replace his choice of equipment supplier meeting the required quality and specification requirement.

During the execution stage if the material from any supplier is found defective / substandard the Engineer / Owner reserves the right to ask the successful bidder to replace his choice of manufacturer / supplier for that particular equipment.

Any change in manufacturer / supplier shall only be entertained if there is sufficient reason that adhering to the original choice of manufacturer / supplier shall be detrimental to either the project quality or project timeline. Proper approval shall have to be sought for change in the choice manufacturer / supplier at least 1 month before the equipment is to be procured.

Samples of all equipments shall have to be got approved prior to their procurement. Any deviation from the BoQ / Specification shall be listed in a separate sheet containing the details of the deviation including the deviating BoQ item number.

**Bidder is required to mark the proposed Manufacturer / supplier and country of origin for each item below**

S.No	Equipment	Manufacturer	Country of Origin	✓
1.	Oil Filled Transformer / PMU	Pak Elektron Limited (PEL)	Pakistan	
		Siemens	Pakistan	
		M-Tech	Pakistan	
2.	MV Cables	Pakistan Cables	Pakistan	
		Newage Cables	Pakistan	
		Pioneer Cables	Pakistan	
3.	MV Cables Accessories (Jointing & Termination Kits)	3M	USA	
		Raychem	USA	
4.	HT – CT / PT	Revalco	Italy	
		Schneider Electric	France	
		ABB	Italy	
		Siemens	Germany	
5.	MV Switchgear	Siemens	Germany	
		Pak Elektron Limited (PEL)	Pakistan	
		Schneider Electric	France	
		ABB	Italy	
6.	LV Switchgear, PFI Panels	Pak Elektron Limited (PEL)	Pakistan	
		Schneider Electric	Pakistan	
		Siemens	Pakistan	
		ABB	Pakistan	
		Hussain & Co.	Pakistan	
		Bilal Switchgear	Pakistan	
		Engineers & Engineering	Pakistan	
7.	Power Factor Plant, Capacitor, Relay, controller	Nokian	Finland	
		RTR	Spain	
		Lovato	Italy	
		Technologic	Italy	
8.	LV Circuit Breakers	Schneider Electric	France	
		Terasaki	Japan	
		Siemens	Germany	
		ABB	Italy	
9.	C.T, Relays & instruments	Schneider Electric.	France	
		Siemens	Germany	
		Revalco	Italy	
		ABB	Italy	

S.No	Equipment	Manufacturer	Country of Origin	✓
10	LV Cables and Wires/ Earthing Cable	Pakistan Cables	Pakistan	
		Pioneer Cables	Pakistan	
		Newage Cables	Pakistan	
		Allied Cables	Pakistan	
		Universal Cables	Pakistan	
		Fast Cables	Pakistan	
11	Load Break Switches, Isolator, Change Over Switches	Gewiss	Italy	
		Kraus & Naimer	New Zealand	
		Legrand	Italy	
		Clipsal	Australia	
12	uPVC Conduits / Pipes and Accessories	Galco	Pakistan	
		Dadex	Pakistan	
		Jeddah Polymer	Pakistan	
		Beta	Pakistan	
		Civic	Pakistan	
13	Back Box / Pull Boxes / Junction Boxes	Hussain & Co.	Pakistan	
		Hensel	Germany	
		Jeddah Polymer	Pakistan	
		Premier Engineering	Pakistan	
14	Switch & Socket Outlets / Floor Boxes	Clipsal (Schneider Electric)	Australia	
		MK Electric	UK	
		Legrand	France	
		ABB	Italy	
15	Cable Glands, Lugs, Terminals and Accessories	Cembre	UK	
		Hubbell / Hawke	UK	
		Hensel	Germany	
16	Cable Tray / Trunking	EZZI Engineering	Pakistan	
		Premier Engineering	Pakistan	
		Hussain & Co.	Pakistan	
		M-Tech	Pakistan	
17	Contactors	Telemecanique	France	
		National	Japan	
		ABB	Italy	
18	Fans and Accessories	Pak Fan	Pakistan	
		GFC Fan	Pakistan	
		Millat Fan	Pakistan	
		Royal Fan	Pakistan	

S.No	Equipment	Manufacturer	Country of Origin	✓
19	Light Fixture	Philips	Netherlands	
		Pierlite	Australia	
		Osram	Germany	
		ConxCorp	Canada	
		EAE	Turkey	
20	Diesel Generator, Fully Imported (Assembled in USA, Europe or Japan) Alternator	<b>Engine</b>		
		Caterpillar	USA	
		Cummins	UK	
		Volvo	UK	
		Perkins	UK	
		John Deere	USA	
		Mitsubishi	Japan	
		<b>Alternator</b>		
		Caterpillar	USA	
		Mecc Alte	Italy	
		Stamford	UK	
		Leroy Somer	France	
		Mitsubishi	Japan	
21	Lightning Protection & Earthing	Erico	UK/USA	
		Furse	UK	
		Dehn	Germany	
		Wallis	UK	
22	UPS	Emerson-Liebert	USA	
		Eaton	UK	
		APC	USA	
		Schneider	France	
		ABB	Italy	
23	Data Communication System and IPTV (Passive Only)	Clipsal (Schneider Electric)	Australia	
		3M/Corning	USA	
		Panduit	Singapore	
24	Telephone Cable	Clipsal (Schneider Electric)	Australia	
		3M/Corning	USA	
		Panduit	Singapore	
25	Fire Alarm System	Gent by Honeywell (EN)	UK	
		Esser by Honeywell (EN)	UK	
		Hochiki	UK	
		Bosch	UK	
26	Closed Circuit Television (CCTV) System	DAHUA	KOREA	
		HoneyWell	USA / UK	

S.No	Equipment	Manufacturer	Country of Origin	✓
		Kedacom	Singapore	
27	Public Address System	TOA	Japan	
		Honeywell	UK	
		Bosch	UK / USA	
28	Exit & Emergency Lighting Fixtures	Menvier	UK	
		Technoware	Finland	
		Emergilite	Italy	
29	Communication Racks & PDU	3M /Corning	USA	
		Schneider	France	
		APC	France	
30	Fire Resistance Cable	Prysmian FP 200 Flex /Gold	UK	
		Draka	UK	
		Cavicel	Italy	
31	Access Control System	HID	UK	
		Honeywell	UK	
		Virdi	Korea	
32	Speaker Cables	Firekas	Turkey	
		Cavicel	Italy	
		Draka	UK	

Technical Specifications

# **Vertical Transportation System**

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## ELECTRIC TRACTION ELEVATORS

### PART 1 – GENERAL

#### 1.1 SCOPE

- A. The specification included in this Section is intended to cover the complete provision and installation of Two (2) Machine Room Above (MRA) Passenger Elevators gearless traction elevators for the Faculty Block Natural and Basic Science Building. All work and material necessary to accomplish this installation in a complete and appropriate manner, except that specifically excluded as “Work by Others”, shall be provided. This work is to be carried out in accordance with the requirements of international and local codes, which may govern the requirements of the installation.
- B. Applicable requirements of the following sections of this specifications apply to all work required under this section.
  - 1. Conditions of Contract.
  - 2. General Conditions of Contract.
- C. Work Installed, but Furnished by Others: (Refer Clause No. 1.8.B.6 & 2.4.G)
  - 1. A life safety, supervised “all building paging” speaker is to be installed in each elevator car canopy.
  - 2. A sound-powered firefighters’ telephone jack is to be installed in elevator car operating station for fire-fighters elevator.
  - 3. Security Card (proximity type) Readers Interface and Computer: Card reader, interface boards, security computer, monitor and keyboard for encoding, overriding, and monitoring restricted access floors on all passenger elevators and service / firefighters elevators. System compatible card readers shall be furnished and installed in each of the above elevators in the elevator main car operating stations with interface controllers and wiring to the machine room junction boxes by the Elevator Contractor. The contractor shall ensure the provisions for

security system related to elevators including data gathering panels in lift m/c rooms and coordinate the work.

4. Remote CCTV color monitors to display elevator car camera signals and hook up to Cat-6 trail cable run to machine room junction boxes. CCTV color cameras shall be furnished in each of the listed elevators by the Building Contractor.

D. Work or Items Furnished, But Not Installed:

1. Firefighters'/Service Elevator car protection pads (one set/car).
2. Three copies of elevator maintenance manuals, operating instructions, wiring diagrams and parts ordering manuals, and lubrication charts are to be furnished. Windows compatible CD or DVD disc containing this information are to be provided.
3. Elevator operating keys (five sets of each key).

## 1.2 COMPLIANCE WITH REGULATIONS/STANDARDS

A. Elevator Equipment shall comply with Manufacturer's Standards such as BS (EN), JIS or ASME and installation works shall comply with BS (EN) and local authorities' requirement.

1. Applicable International Building Code (IBC) 2003
2. Applicable Local Building Laws
3. Local Codes, Ordinances and Laws
4. BS 5655 Current Edition
5. ASME A17.1-2005 Safety Code for Elevators and Escalators
6. Elevator Inspectors' Manual, ASME A17.2-2004
7. BS 7671, Requirements for Electrical Installation, IEE Wiring Regulations, 17<sup>th</sup> Edition
8. National Electrical Code No. NFPA 70-2002

9. BS (EN) 81.1, Safety rules for Construction and Installation of Lifts – Electric Lifts.

10. BS 5588-5, Fire Precautions in the Design, Construction and use of Buildings, Part 5: Code of Practice for Firefighting stairs and lifts.

11. All lifts to comply with NFPA 101 Life Safety Code.

B. Permits: Obtain and pay for all local construction permits, commissioning inspections, and the first year's elevator operating permits.

C. Local codes shall have priority over all other codes in case of difference between codes.

### **1.3 PRODUCTS**

A. Approved Manufacturers:

1. Gearless Elevators of the following manufacturers and countries of origin or Equivalent are approved brands.

- Sigma Otis (Korea/China)
- Hyundai (Korea/China)
- Schindler (Europe/China)
- Kone (Europe/China)
- Sodimas (Europe/China)
- Suzhou Fuji (China)

a. Elevator contractor shall be capable of providing maintenance service, including adequate local parts inventory within the city of Karachi.

b. Contractor shall be capable of providing 24-hour-a-day emergency service and respond to trouble calls within 1-1/2 to 2 hours and passenger entrapments within 30 minutes of notification.

- c. Contractor shall employ competent personnel, experienced in elevator maintenance.
- d. Contractor shall perform all maintenance during specified maintenance period and shall offer contract maintenance service to Owner. Maintenance service shall not be assigned or transferred.
- e. Elevator contractor shall be authorized sole representative of the manufacturer. A certificate of authorization from the principal shall be provided by contractor.

## 2. Guarantee:

- a. The materials and workmanship of the elevator apparatus installed shall comply in every respect with these specifications. Any defects (not due to ordinary wear and tear, or improper use or care) which may develop within 1 year from date of final acceptance and/or beneficial use of each individual elevator shall be corrected to the satisfaction of the Architect/Engineer at no additional cost.
- b. The Elevator Contractor shall make any and all modifications, adjustments and improvements to the elevator systems necessary to meet the performance requirements specified in Part 2.2 of these specifications.

## 1.4 SUBMITTALS AND SAMPLES

- A. Within 20 days after receipt of Notice to Proceed, submit soft copy of Windows CD or DVD and three copies of the shop drawings and required material for review. In general, the following are required:
  1. Shop Drawings: Equipment arrangement, entrances and car enclosures. Provide drawings at the following scale: hoistway sections 1:50; hoistway shaft details 1:50; hoistway and machine room plans 1:20; elevator cars and hoistway entrances 1:20; fixtures 1:10.
  2. Design Data: Indicate equipment lists, reactions, rail loads and stacking plan, door weights, heat emissions, stack effect remediation, ride quality, wind loads, and relevant design information on layouts.

3. Power Data: Provide Kilowatts load, accelerating current, full-load running current, demand factor and regenerative loads for applicable motors and power conversion units.
4. Finish Material: Submit samples as per the Architect/Engineer's requirements. Submit samples of the following: 30 cm x 30 cm materials and finishes exposed to view; welded entrance frame detail, engraving (1 word in each size); extruded stainless steel car sill.
5. Fixtures: Submit cuts and shop drawings and samples of all fixtures including one of each of the following: each type of hall lantern; hall pushbutton; light fixture; car operating panel; color LCD display screen; elevator monitoring CRT, CPU and keyboard, etc.
6. Manufacturer's Certificates: Submit certificate of elevator performance with As-built drawings and documents. After adjustments, test, and inspections are performed, forward certificate signed by Elevator Manufacturer stating that the equipment and controls provide the level of elevator service and ride qualities specified. Include certification that elevator hoistway doors, frames, transom panels, hardware and accessories comply with specified fire rating requirements.

## **1.5 MAINTENANCE**

- A. The Contractor shall provide maintenance service for 12 months, which shall include the following:
  1. Preventative maintenance on all equipment described herein for a period of 12 months commencing on date of final acceptance by Owner of each elevator unit, including unlimited 24-hour emergency callbacks. The maintenance shall include systematic examinations, adjustment, cleaning and lubrication of all equipment. The Contractor shall also repair or replace electrical and mechanical parts whenever required and shall use only genuine, standard parts produced by the Manufacturer of the equipment installed. Maintain elevator machine rooms, hoistways, and pits in clean condition.
  2. All maintenance work shall be performed by competent personnel under the supervision and in the direct employment of the Contractor.

3. Consumable materials and spare parts for 12 months maintenance period shall be included in the bid price.
4. Preventive maintenance program indicating activities and their frequency shall be submitted with the bid.

## **1.6 MATERIALS**

The materials shall comply with following standards:

- A. Steel: Low carbon, cold rolled to stretcher leveled standard flatness as per ASTM A366 for sheet steel and ASTM A36 for structural steel.
- B. Stainless Steel: Type 304 with No. 4 or 8-polished directional finish on exposed surfaces as per ASTM A167, as specified. Furnish to be as per Architect/Engineers requirements.
- C. Aluminum: Extrusions per ASTM B221; sheet and plate per ASTM B209.
- D. Paint: All exposed metal work furnished under this section, except as otherwise noted, shall be cleaned of oil, grease, scale and other foreign matter and factory painted with two coats of Manufacturer's standard rust-resistant primer. After erection, provide two finish coats of industrial enamel paint. Galvanized metal exposed inside of the hoistway or in the machine room need not be painted (except as noted). Field paint and touch up any ferrous metal that is exposed or welded during construction or installation.
- E. Prime Finish: Clean all surfaces receiving a baked enamel finish of oil, grease, scale, etc. Apply one coat of rust-resistant mineral paint followed by a filler coat over uneven surfaces. Sand smooth and apply final coat of mineral paint.
- F. Baked Enamel: Prime per "E" above. Apply and bake three additional coats of enamel in the solid color and finish as selected by the Architect.

## **1.7 ELEVATOR CARS:**

- A. General – All Elevators complete cars shall be delivered to the jobsite by the contractor.

Elevator Contractors shall provide cars as specified in the relevant section of these specifications. The cars are to include all interior finishes, the ceiling and interior lighting. The car platforms, steel shells, plenums, emergency exits and contacts, front returns, transoms, and doors, sills, stiles, slings, safety plank, roller guides, headers, door operators, controls, toe guards, emergency exit and contacts are to be included in the bid.

B. Cars: The Elevator Contractor shall provide all drawings and materials included in this specification and install the cars. The Elevator Contractor shall also be responsible for the following:

1. Provide and install all electrical controls and signal fixtures and wire complete.
2. Provide and install conduit and wiring to lighting and ventilating fixtures.
3. Provide and install car door headers, tracks and threshold.
4. Provide and install car door hangers and gibs on car doors and hang doors.
5. Provide and install car operating panels and position indicator controls, sound-powered telephone jacks, car telephones, service panels, and faceplates.
6. Install life safety speakers and CCTV cameras in car canopy and security card readers in car front return; cameras and card readers and speakers provided by Building Contractor (Refer clause 1.1C 3&4).

## **1.8 KEYS**

A. Five sets of keys to operate all keyed switches and locks shall be furnished upon completion. Keys shall be tagged properly. All keying shall be arranged with the Building Owner.

## **1.9 HOISTING**

This clause is related to general attendance to be provided by Elevator Contractor at no extra cost as part of the contract for the following items:



- Unloading, distributing, hoisting craneage and lowering of materials, equipment machinery or the like.
- Scaffolding, including mobile platforms or provision of any specialist scaffolding.
- Provision of all specialist lifting, hoisting, craneage etc. for off loading, positioning and installation of services equipment.

## PART 2 – TECHNICAL SPECIFICATIONS

### 2.1 ELEVATORS SCHEDULES

#### 2.01 Passenger Elevators: **Machine Room Above (MRA) Type**

Number of Cars:	Two (2) Elevators
Capacity:	800 Kg ( persons)
Speed:	1.0 m/s
Roping:	1:1 or 2:1
Control:	Sigma Otis, Hyundai, Schindler, Kone, Sodimas, Suzhou Fuji make or Equivalent Brand Microprocessor based Duplex Selective Collective system (latest version)
Encoder:	Machine-Room Mounted, Digitally pulsed type
Motor Control:	ACV <sup>3</sup> F with automatic leveling and digital closed-loop motor feedback
Power Converter:	I.G.B.T. Converter/Inverter regenerative drives equipped with isolation transformers and EMI filter networks
Power Characteristics:	400 Volts, 3-Phase, 50 Hertz
Stops:	3 Stops and openings in line
Floors Served	G, 1- 2.
Travel:	6.7 M <sub>±</sub>

Car Inside:	1850 Wide X 1950 Deep X 2175 High (To Dropped Ceiling)
Entrance Size:	800 Wide X 2100 High
Entrance Type:	2-Panel, Center Opening
Door Operation:	High-Speed, Heavy-Duty, Closed-Loop Master ACV <sup>3</sup> F Door Operator (Minimum Opening Speed 0.75-0.90m/Sec)
Door Protection:	Infrared, pulsed matrix proximity detectors with variable timing feature and nudging Door edge Mechanical Protection.
Machine:	Overhead Gearless Traction (ACV <sup>3</sup> F PMSM or Induction Type)
Guide Rails:	Planed Steel Tees
Buffers:	Oil, spring return with access ladders, inspection platforms and blocking
Compensation:	Wire Rope and Pit Sheaves
Car Enclosure:	As specified in relevant sections of these specifications
Entrances:	As specified in relevant sections of these specifications
Signals –	
Registration Lights:	Car and hall touch buttons wall mounted
Position Indicators:	Car (Dual Color LCD Digital Type), Lobby
Communication System:	Intercoms and Distress Signal System
Car Video Camera:	CCTV Pinhole Color Camera Installation and providing Cat-6 Trail Cables
Life Safety:	All Building Paging Speaker
Additional Features:-	Up fall and unintended car movement protection (individual, dual acting hoist machine emergency

brakes, counterweight safeties or hoist machine rope brakes).

Car and Counterweight Roller Guides

Car Top Inspection Station

Access Panel in Car Ceiling

Automatic Emergency Landing Device, Battery Powered to lead car to nearest landing in event of power failure and doors to open

Emergency Car Lighting with Battery Packs, Chargers and a Test Button

Zone 2B Seismic Designs and Operations

Single Car Operating Panels

Hinged Car Front Return Panels

Car Card Reader Installation, Trail Cables and Interface Box

Hoistway Access Switches

Independent Service Feature

Platform Isolation

Load-Weighing Device (Pre-Dispatch and Hall Call Bypass)

False-Call Canceling

Conduits and Remote Wiring to Control Panels

Rail Backing (As Required)

Extruded or Milled Stainless Steel Car Sills (Narrow)

Fire Fighter's Lift features as per codes in one of the two lifts

Hoistway Sill Support Angles

12-Month Maintenance with 24-Hour Callback Service

Machine, Power Converter and Controller Sound Isolation

As-Built Wiring Diagrams, Operating Instructions, Maintenance Instructions, Parts Ordering Information, and a Lubrication Chart

## 2.2 PERFORMANCE

- A. Speed:  $\pm 3\%$  under any loading condition or travel direction.
- B. Capacity: Safely lower, stop and hold up to **125%** of the rated load.
- C. Stopping Accuracy: 6 mm under any car loading condition.
- D. Door Times: The door **opening** time shall be measured from the instant the doors start to open until they are in the fully open position.

The door **closing** times shall not be less than those permitted by the ASME A17.1 Code, Rule 112.4.

The door opening times and the door closing times shall meet the requirements as per the relevant codes.

- E. Floor-to-Floor Time: Floor-to-floor time shall be measured from the instant the doors start to close at one floor until the car is level and stopped at the next floor. Doors shall not be more than 3/4 open before the car is level and stopped. These performance times shall be obtainable with dependable, consistent operation without undue wear or stress on the equipment and without excessive maintenance. The elevator shall provide a comfortable ride with smooth acceleration, retardation and a soft stop. The time for the elevators to travel from floor to floor under any loading condition shall not exceed the stipulated limits as per codes.
- F. System-Response Time: The group passenger system-response times for the indicated group elevators as measured by registration of hall calls, shall meet the criteria as stipulated by the relevant BS codes during any 15-minute period of the day with all passenger elevators in group service.

The system response time requirements are to be based upon not more than 125 hall calls being registered within each 15-minute period. The system-response time for service at floors not served by all group elevators shall not be included in the verification of system-response time performance.

At the completion of the project, and when the passenger elevator group floors are at least 80% occupied, the Elevator Contractor shall record each elevator group's system response time and submit the results to the elevator consultant for verification.

### **2.3 NOISE AND VIBRATION CONTROL**

- A. All elevator equipment (including hoist machines, deflector sheaves, power conversion units and support equipment) shall be mechanically isolated from the structure and electrically isolated from the building power supply and each other to prevent noise and vibration being transmitted to occupied area of the building.
- B. Elevator equipment shall be designed, installed and adjusted to meet the performance requirements of Section 2.2 within the following parameters.
  - 1. Horizontal acceleration (postwise and front to back) within cars during all riding and door operating conditions shall not exceed 15mg peak to peak.
  - 2. Acceleration and deceleration shall be constant and shall be at least  $1.0\text{m}/\text{sec}^2$  on the gearless elevators and not exceed  $1.4\text{m}/\text{sec}^2$  with an initial ramp between 0.5 and 0.75 second.
- C. Measured noise levels relating to elevator equipment and its operation shall not exceed 50-66 dBA in the elevator cars and lobbies and 75 dBA in elevator machine room under any condition including door operation and car exhaust fan on highest speed.

### **2.4 CONTROL SYSTEM**

- A. Operational Control: The various systems specified hereafter shall be provided for each elevator/group per the elevator schedules.

1. Microprocessor-Based, Simplex Selective Collective: Elevator shall operate without an attendant from buttons located at each floor entrance jamb and in the car. The registration of a hall call, when the car is idle, shall automatically start the elevator and dispatch it to the corresponding floor. If a call is registered at the floor where the car is idle, the doors shall automatically open.

Once the direction of travel has been established, the car will not reverse direction until all car calls have been answered or until all hall calls, ahead of the car and corresponding to the direction of car travel, have been answered.

The car shall slow down and stop automatically at floors corresponding to registered calls, in the order in which they are approached in each direction of travel. As slowdown is initiated for a hall call, that call shall be automatically canceled and the hall button for that direction of travel remain ineffective until the car leaves the floor. Car calls shall be similarly canceled.

The car shall only answer calls corresponding to the direction in which the car is traveling except that it may answer a call in the opposite direction if that call is the highest (or lowest) call registered.

Registration of a call shall cause the appropriate button to illuminate. When the call is answered, the light shall go out.

2. Microprocessor – Based, Duplex Selective Collective: Elevators shall operate without attendants from buttons in each car and at each floor. With two cars in service and no calls registered, one car shall normally park at the service level entry floor (“home” car). The other car shall park where last used (“free” car). Registration of a hall call above the entry floor or a car call in the free car shall cause that car to start and begin operation. When a car has been started, it shall respond to calls registered for the direction of its travel in the order in which the floors are reached. Once the direction of travel has been established, the car will not reverse direction until all car calls have been answered or until all hall calls, ahead of the car and corresponding to the direction of car travel, have been answered.

Cars shall slow down and stop automatically at floors corresponding to registered calls, in the order in which they are approached in each direction of travel. As slowdown is initiated for a hall call, that call shall be automatically canceled and the hall button for that direction of travel remain effective until the elevator leaves the floor. Car calls shall be similarly canceled.

The cars shall only answer calls corresponding to the direction in which the car is traveling except that it may answer a call in the opposite direction if that call is the highest (or lowest) call registered.

When the free car is clearing calls, the home car shall respond to:

- a. A call registered on the home car buttons.
- b. An up hall call registered below the free car while the free car is traveling up.
- c. An up or a down call registered above the free car while the free car is traveling down.
- d. A hall call registered and the free car is delayed in its normal operation for a predetermined period.

When both cars are clearing calls, only one car shall stop in response to any registered hall call. The first car to clear its calls shall return to the main floor and become the home car. Should the last service required bring both cars to the main floor, the car that arrived first shall become the free car.

Registration of a call shall cause the appropriate button to illuminate. When the call is answered, the light shall go out.

### 3. Additional Features:

- a. Anti-Nuisance Feature-Passenger Elevators: In the event car loading or operation is not commensurate with the number of car calls registered (when the elevator is in automatic operation), all false car calls for that elevator or deck shall be automatically canceled.

- b. Load Weighing-Passenger Elevators: Provide under platform mounted micro switches or strain gauges or for weighing the passenger load in each elevator when they are in automatic operation. Design the control system to provide dispatching in advance of normal intervals and to provide landing call bypass when the car is filled to approximately 50% of full-capacity load. Settings shall be individually adjustable from 50-70% of full load.
- c. Artificial Intelligence Systems: Include one or more "artificial intelligence" approaches to maximizing the interfloor traffic performance and reducing the number of "long wait calls" for group of elevators.

Contractor shall supply full details of his preferred approach to these requirements with his bid response.

- d. Stopping Accuracy: An automatic 2-way stopping and leveling device shall be provided, designed to govern the stopping accuracy of the car to within  $\pm 6$ mm above or below the landing sill. This operation shall be effective to avoid overtravel, as well as under travel, of the car and maintain the stopping accuracy regardless of the load in the car, direction of travel, rope slippage or stretch.
  - e. Remote Monitoring and Diagnostics: Equip each car controller and the group dispatch logic controller with standard ports, interface boards, and drivers to accept maintenance, data logging, and fault finding diagnostic computers, keyboards, modems, and programming tools. The system shall be capable of driving remote color LCD monitor(s) that continually scan and display the status of each car and call. Provide each group with a full, interactive elevator monitoring (EMS) system.
- B. Independent Service: Provide controls for operation of each elevator from car buttons only. Under this operation door closing shall be initiated by activating the desired destination floor button or the door close button.

Attendant Service Feature – Provide for elevators as specified in Elevator Schedule.



- C. Door Operation-Passenger Elevators: Doors shall open automatically when the car arrives at a floor to permit the transfer of passengers. When another car is at the lobby floor terminal and is loading for departure or upon expiration of a timed interval, the doors shall close until the arriving car is designated for loading. In the event a passenger has entered the elevator, before it is assigned for dispatching, the doors shall reopen upon registration of a 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. Equip the car doors with preopening circuits so that the doors are about  $\frac{3}{4}$  open when the elevator is level at the landing.
- D. Door Operation-Service Elevators:
1. Doors shall open automatically when the car arrives at a floor to permit egress of passengers and carts. After the timed interval, the doors shall automatically close. Equip the car doors with preopening circuits so that the doors are approximately  $\frac{1}{2}$  open when the elevator is level at the landing.
  2. Include an extended door hold open button in the main car operating panel to extend the door hold open time (10-20 seconds, time to be adjustable thru the E.M.S. keyboard) to facilitate cart transfers when the elevator is on automatic service. Registration or re-registration of a car call shall cancel the hold open time.
- E. Emergency Features:
1. Firefighters' Service: Equip the elevators with control system to operate and recall the cars during a fire or other emergency condition per ASME A17.1-2005, Section 2.27. Provide terminals on the controller for connection of signal from sensors provided in other sections of the work. Operation shall be similar on all elevators and visual/audible signal shall operate until return is complete or automatic operation restored. Provide the designated level and alternate return level sequencing per the Local Fire Authority Requirements.
  2. Emergency Car Lighting and Emergency Alarm Unit: Car-mounted or machine room mounted battery unit including solid-state charger and

testing means enclosed in common metal container. Battery to be rechargeable nickel cadmium, lead acid, or gel-cell type with a 10-year minimum life expectancy. Mount the emergency call bell on each car top. Locate emergency lamps above the car dropped ceiling so that the unit is not readily visible from the car interior but gives sufficient intensity to provide at least 50 lux measured at a height of 1 meter above the car floor. Alternately, if incandescent car interior lights are provided as a part of the car design, illuminate two of these lamps during an emergency lighting condition. Locate an emergency lighting test button in the car service panel. A main line power failure or pressing the test button shall illuminate the emergency lighting bulbs.

3. Automatic Emergency Landing Device: In the event of normal power failure, an automatic battery powered landing device shall bring elevators to the nearest landing and doors shall open.
4. Standby Power Transfer: In the event of normal power failure, adequate standby power will be supplied through normal feeders to start and run Elevators designated full time at rated speed. Provide controls to automatically start and run the cars nonstop to the designated terminal, one car at a time. E.M.S. selection controls shall also be provided in the command center panel so that any alternate group elevator may be selected to run continually. Under either mode of operation, only designated elevators shall be running on standby power at a time. Provide standby power to run the elevator E.M.S. system, the intercom system and all car lights, exhaust fan and emergency call bells.
- F. Car-to-Lobby Switches: Provide a switch or E.M.S. keyboard operations for each elevator in the command center control panel to return the car to the lobby floor. Activating the switch (control) shall cause the car to return to the lobby floor while bypassing hall calls but answering registered car calls en route.
- G. Security System: Provide means to limit elevator access to selected floors. The security shall function as follows:
  1. Computer input commands may be entered into the interactive elevator monitoring system keyboard located in the command center

console to prevent registration of car calls to any selected floor on the elevators when they are in normal operation.

2. The Elevator Contractor shall install proximity type card readers (provided by Other Trades) in the elevators, as specified in Elevator Schedule, car main operating panel and security system interface controllers in the machine room car controllers listed. Hook up the readers and the interface controllers to enable properly encoded cards accepted by the car readers to override selected floor blocks initiated in the E.M.S. system and permit car call registration. Provide all required elevator interface boards, junction boxes wiring and installation to form a complete system.
  3. Elevators shall serve all floors when on independent or attendant service irrespective of floor security status.
  4. System shall be arranged so that firefighters' operation controls shall override floor security block outs.
  5. When on the security mode, the hall lantern for restricted floors shall operate normally when the car arrives at a level and the elevator is in automatic operation.
- H. Sound-Powered Telephone Jack: Install a sound-powered telephone jack (provided by the Life Safety Contractor) and wiring in each elevator car. The system shall provide for 2-way communications between all of the stations with the wiring terminating at each machine room car controller's junction box.

## **2.5 MACHINE ROOM EQUIPMENT**

- A. Arrange equipment in machine rooms. Provide identifying numbers on machine, power-conversion unit, controller, data concentrator and main line and auxiliary disconnect switch.
- B. Gearless Traction Machine:
  1. ACV<sup>3</sup>F induction or P.M.S.M. gearless traction type motor with brake, drive sheave and deflector sheave mounted in proper alignment on a common, isolated bedplate. Machine shall have sealed ball or roller

bearings and meet testing requirements without external cooling. Single-wrap, traction hoist machine drive sheaves with "V" grooves shall be provided with friction reducing liners or be equipped with a minimum of 6ea., 13mm diameter or larger steel hoist ropes. Provide blocking to elevate secondary or deflector sheave above machine room floor.

2. Elevators shall be equipped with overhead gearless hoist machines equipped with steel hoist ropes and a minimum 40:1 hoist rope diameter to machine drive sheave ratio. Synthetic hoist ropes or steel messenger polyurethane flat belt suspension means are not acceptable for these units.
  3. Isolate the machine or bedplate and the deflector sheave from the building structure in order to minimize noise vibration transmission into occupied area of the building.
  4. Provide ACV<sup>3</sup>F induction motors with thermostatically operated cooling blowers, shrouds and mounting means.
  5. Provide a direct drive, digital, closed-loop velocity encoder on hoist machine.
  6. Provide dual, double independently operated disc or drum brakes to meet the "up-fall" elevator protection requirements.
  7. Hoist machine installations, which require blockouts through machine room, floor for other than hoist ropes shall be provided with a 14-gauge galvanized sheet metal smoke closures over entire blockout on underside of machine room floor slab.
- C. Power Conversion and Regulation Units: Provide solid-state, alternating current variable voltage, variable frequency (ACV<sup>3</sup>F) I.G.B.T. converter/inverter drives. The units shall be designed to limit current, suppress noise and prevent transient voltage feedback into the building power supply. Provide internal heat sink cooling fans for the power drive portion of the converter panels. Isolate unit from the building structure to minimize noise and vibration transmission. Provide each unit with isolation transformers, line filters, noise filter networks, and choke inductors, as required. The Elevator Contractor shall be responsible for all required

corrections to suppress solid-state converter noises (audible and vibratory), radio frequency interference in unit, or eliminate regenerative voltage transients induced into main line feeders or the standby power generator. All gearless ACV<sup>3</sup>F drives shall be regenerative and utilize dynamic braking during an overhauling condition. Supplement direct-current power for the operation of the hoist machine brake, door operator, dispatch logic processors, and signal fixtures, etc., shall be supplied from separate, static power supplies.

- D. Encoder: Encoders shall be provided and mounted in the machine room. The encoders shall be the solid-state, optical, digital-count type, mechanically coupled to the car via a slotted tape with drive sheaves and a pit-tensioning sheave or driven from the car governor. Optical, inductive pulse, or mechanical cam-type tape encoders or rail "friction" encoders mounted in the hoistway shall not be used on the gearless elevators.
- E. Controller: Cabinet type controller shall be provided, with removable doors or drawers and adequate ventilation fans to dissipate heat complying with NEC Code Article 110-16(a) working clearances. Wire to identified terminal block studs. Identifying symbols or letters identical to those on wiring diagrams permanently marked adjacent to each component on the controller. Provide the proper ampere rating marked adjacent to all fuse holders. Each car controller, the group dispatch controller and data concentrator panels (if provided) shall be equipped with plug-compatible diagnostic ports, system monitoring ports, and remote LCD drivers and plugs. Provide the dispatch controller or data concentrator panel with a 56k modem and data card for the remote monitoring telephone line connections.
- F. Security Interface Cabinet: Provide cabinet for all elevators equipped with on board security card readers. The cabinet shall contain all interface terminals and the elevator interface computer boards, including:
  - 1. Card reader interface (six shielded wiring pairs per card reader elevator).
  - 2. Card reader control mode (one shielded wiring pair per card reader elevator).

3. Floor select button enable (one shielded pair per floor or multiplexed/zone per card reader elevator).
  4. Emergency-stop pushbutton monitoring, if provided (one shielded pair per card reader elevator).
- G. Templates, Forms, Sleeves and Guards: All templates, forms and sleeves for providing necessary openings in the concrete slab over the hoistway shall be provided as part of this work. Sleeves for conduit and other small holes shall project 25mm above the concrete slab. Provide 25mm steel angle guards around hoist cables, governor ropes, encoder tapes, or duct slots that penetrate the machine room slab. Provide approved rope and smoke guards for sheaves and cable machine room slab penetrations.
- H. Machine Beams: Provide structural steel beams required for support of the elevator machine, secondary sheave, overhead sheaves, governors and dead-end hitches. Provide bearing plates, anchors, shelf angles, blocking, etc., to support beams and equipment. Elevator Contractors shall provide special slab support shelf angles welded into the webs of their machine beams, if required, to support the machine room slab and decking. Cope the machine beams and weld them to the building support steel, as required by the Structural Engineer for proper load transfer.
- I. Governor: Centrifugal type, car and counterweight driven with pull-through jaws. Provide two bi-directional electrical shutdown switches and any overhead supports required which are additional to building structure.

## **2.6 HOISTWAY EQUIPMENT**

- A. Guide Rails: Steel T-section suitable for travel, car and counterweight weights, seismic accelerations and support locations at structural floors. Provide rail backing, intermediate counterweight tie brackets, divider beams and hoistway inserts, if necessary, to meet ASME A17.1 Code requirements and the specified ride qualities. NOTE: only Other Trades will provide those supports indicated on the structural drawings. The Elevator Contractor shall be responsible for any additional divider beams, rail supports, brackets or attachments.

- B. Buffers: Oil type with any blocking, supports, and permanent inspection ladders and platforms (required where the car and/or counterweight buffer oil inspection port is located 2.0m or more above the pit floor). Provide reduced stroke buffers if required, to meet the minimum code overhead requirements.
- C. Sheaves: Machined grooves with ball or roller bearings. Provide mounting means to machine beams, machine bedplate, car and counterweight structural members, etc. Provide drip pans under 2:1, overhead, and deflector sheaves, rope guards on drive, compensation, 2:1 and all secondary sheaves. Provide car top and counterweight 2:1 sheaves with removable top metal dust covers and guards. Provide lock down compensation pit embedment items and support channels, if required.
- D. Governor and Encoder Pit-Tensioning Sheaves: The sheaves shall be mounted to pit support members or the rails and provided with guides or pivot points to enable free vertical movement.
- E. Compensation Gearless Elevators: Rope type (lock down type on elevators with speeds greater than 3.5mps or with travels in excess of 100M) with pit-tensioning sheaves. Provide electrical contacts on tension sheave to stop elevator on sheave over or under travel.
- F. Counterweight: Channel construction, steel channel frame with metal filler weights, and 2 subweight retainer rods that pass through all subweights and the counterweight crosshead, guided by four sets of roller guide shoes. Each roller guide shall have three rollers of a diameter sufficient to limit the rotational speed to less than 1000 r.p.m.
  - 1. Provide seismic counterweight retainer plates on the top and bottom of each counterweight frame on elevators.
- G. Counterweight Safety: Per Code. Provide on all elevators with "occupied" spaces below their pits and as indicated in Elevator Schedules.
- H. Counterweight Guard: Metal guard around counterweight in pit, per code.
- I. Hoist and Governor Ropes:

1. 8 x 19 or 8 x 25 seale construction traction steel type; use 13mm minimum diameter for all hoist ropes.
  2. Governor rope with adjustable wedge type shackles.
  3. Fasten hoist ropes or belts with adjustable, wedge type shackles.
  4. 2:1 roping dead-end hitches shall be provided with dampening springs.
- J. Normal and Final Terminal Stopping Devices: As per Code. Provide emergency terminal slowdown devices, if required, to meet the minimum Code overhead and pit depth requirements.

K. Electrical Wiring:

1. Conductors: Stranded copper throughout with individual wires coded and all connections on identified studs or terminal blocks. Use no splices or similar connections in wiring except at terminal blocks, control cabinets, junction boxes. Provide 10% spare conductors throughout. Flexible conduit shall not be used on flat portions of the car top.
2. Conduit, Etc.: Painted or galvanized steel and duct. Conduit size shall be 20mm minimum. Flexible conduit exceeding 45cm in length or mounted on flat portions of the car top shall not be used. Flexible heavy-duty service cord may be used between fixed car wiring and car door protection light matrix junction boxes.
3. Traveling Cables: Flame and moisture-resistant outer cover. Include six sets of shielded communication wires and car lighting circuits from machine room to car connection points. Prevent traveling cables from rubbing or chafing against hoistway or car items. Traveling cables exceeding 30m in length shall be supported with steel internal messenger wires. Provide a continuous vertical strip of wire cloth between the cables and hoistway items. Provide each set of traveling cables with 10% spare conductors and 4 spare sets of shielded pairs and a coaxial or dedicated CCTV monitor cable(s).

L. Entrance Equipment:



1. Door Hangers: 2-point suspension with upthrust adjustment. Hanger rollers shall be equipped with polyurethane insert tires; no metal-to-metal contact permitted.
2. Door Tracks: Bar or formed, cold-drawn steel with smooth hanger contact surface. Tracks shall be removable for replacement.
3. Interlocks: Type operable without retiring cam. Provide fire-resistant wiring, NEC, Type SF-2 or equivalent.
4. Closers: Spring, spirator, or weighted type attached to the entrance struts.
5. Relating Cables: Provide between door panels, include stainless steel aircraft cord, swaged fasteners, sheaves and adjustment clips.
6. Provide the emergency "blind" hoistway access doors located in the express run portions of the hoistway(s), if required, with electrical contacts and closers per ASME A17.1, Rule 2.11.1.2.

M. Pit Stop Switch: As Per Code.

N. Floor Numbers: Provide painted 10cm high fire floor numbers within the hoistway as per ASME A17.1 Code, Rule 2.29.2.

## **2.7 HOISTWAY ENTRANCES**

- A. Summary: Provide complete entrances with the clear dimensions and finishes indicated. Entrance for Fireman Elevator S1 shall be 2-hour fire rated.
- B. Frames: No. 14 U.S. gauge steel welded and mitered construction.
- C. Door Panels: No. 16 U.S. gauge steel with 2 removable, fire type gibs located .3m on center per panel. Doors with heights greater than 2.10m shall be constructed with interlocking stiffening ribs. Providing all door panels with top and bottom fire safety retainer clips that mesh with the entrance jambs when in the closed position per ASME A17.1 Code Rule 2.11.11.8.
- D. Sight Guards: Same material and finish as door panels.

- E. Transoms: Provide fire rated flush transoms and offset, sheet type transoms at indicated openings.
- F. Sills: Passenger elevators extruded or formed stainless steel at the ground and Concourse entrances. Provide extruded aluminum sills at all other floors. Provide and install "groutless" steel angle sill supports for all entrance sills.
- G. Fascia, Toe Guards, Dust and Hanger Covers: No. 14 U.S. gauge furniture steel with Manufacturer's standard dark color enamel finish.
- H. Struts and Headers: Provide for necessary support of entrances and related material. Provide door open rubber bumpers on each entrance support strut.

## **2.8 CAR EQUIPMENT**

- A. Car Frame: Welded or bolted steel channel construction.
- B. Car Safety Device: Type B, flexible guide clamp type.
- C. Platform: Isolated type constructed entirely of steel; Class "A" freight loading.
- D. Guide Shoes: Roller type with three or more sound-deadening rollers per shoe. Maximum rotation speed, 350rpm up to speeds of 5.0mps.
- E. Floor Covering: Inset Stone or granite as approved by the Architect/Engineer set with thin set mortar in passenger elevators.
- F. Car Sill: Narrow type, extruded or formed stainless steel, set at a height to be flush with the finished car flooring.
- G. Toe Guard: As Per Code.
- H. Car Door Hangers and Tracks: Conform to specification on hoistway entrance hangers and tracks. Equip doors with polyurethane-tired hanger hollers.
- I. Header: Constructed of 5mm thick steel shaped to provide stiffening flanges, securely mounted and braced to the car top.

- J. Car Door Clutches: Provide heavy-duty clutches, vanes, linkage arms, drive blocks and pickup rollers or cams to provide positive, smooth, quiet door operations and up to 75-150mm of predoor opening. The clutches shall be designed with movable vanes to permit the car doors to be closed while the hoistway doors remain open at the floor for maintenance purposes. Provide car doors with restrictors per ASME A17.1 Code Rule 2.12.5.
- K. Car Door Electrical Contact: Electrical contact to operate in conjunction with the car doors so that elevator cannot operate unless doors are closed or within tolerance allowed by Code.
- L. Door Operator: High-speed, heavy-duty, ACV<sup>3</sup>F closed loop, door operator capable of opening doors at no less than .75 to .9mps and accomplishing reversal in no more than 6.5 cm of door movement. Provide Service elevator with medium-speed, heavy-duty ACV<sup>3</sup>F closed loop, door operators with a minimum opening speed of .33mps. Arrange operator so the car doors can be opened by hand from inside the car in case of power failure, if it is within the hoistway door-unlocking zone.
- M. Door Reopening and Control Devices:
1. Car Door Reversal Device: A solid-state electronically operated infrared door reversal, proximity device shall be installed on the car doors. The device shall contain specially designed electronic components enclosed in an insulated chassis. The device will create a criss-cross matrix of invisible, infrared, light beams, minimum 32 beams, which shall scan the car doorway and shall detect, through the breaking of any light beam, any opaque object that may be placed in its path. Provide the service elevators with special "3D" type units to respond to entering cart traffic.  
  
After a car stop is made, the door shall remain open for a predetermined interval before closing. If, while the door is closing, the matrix of invisible light beams is interrupted by a passenger or an object entering or leaving the car, the door shall stop and reopen, after which the door shall again start to close.
  2. Door Open Timing Feature Service Elevators: Timing feature shall operate in conjunction with door light ray matrix to provide adjustable,

reduced, hold-open time once rays are broken and reestablished. In the event rays are broken beyond an adjustable time, a buzzer shall sound and doors try to close at reduced speed.

3. Variable Timing Feature Passenger Elevators: Provide separately adjustable timers, to enable varying the time that the hoistway doors remain open after stopping in response to a car call or a landing call. The dwell time for a car call stop shall be adjustable between 1 and 4 seconds and the timing for a landing call stop shall be adjustable between 3 and 8 seconds. If a stop is made in response to both a landing call and a car call, the timing of the landing call shall predominate. In the event that the light beam is interrupted while the doors are opening or after the doors are fully open, the time that the doors remain open after the light beam has been reestablished shall be reduced to an adjustable time between 2 and 1 second, depending upon whether a landing call or a car call predominated. This time shall also be a minimum time that the doors remain open if the door protection beams are interrupted and reestablished before the door is fully open.
4. Nudging Action: In the event, a door protection light beam is continually obstructed, or the door hold open button is continually activated, for a predetermined time interval (20 seconds) after automatic door closing has been initiated, a buzzer shall sound and the doors shall be closed at a gentle, reduced speed. Timers shall be individually adjustable.

#### N. Car Control Stations:

1. Two opposite-hand car control stations with stainless steel flush mounted faceplates containing the operating fixtures, and a lockable service panel shall be mounted in the car front return panels on the passenger elevators. A single car operating station with a brushed stainless-steel faceplate, recessed mounted with tamperproof screw shall be provided for the service elevators.
2. The front return panels or faceplates shall be engraved and filled with the identifying number of each elevator and its capacity in KG and number of permitted persons. The floor call buttons, alarm button, door

open button, and emergency stop switch shall be suitably identified by permanently applied, tactile symbols and markers. All automatic operating controls (provide vandal-resistant type on the Service Elevator) shall be located no higher than 135 cm above the car floor (90 cm for stop switch and alarm button). Engrave and fill CERTIFICATE OF INSPECTION ON FILE IN THE BUILDING OFFICE and NO SMOKING at the top of the return panels or faceplates in each car. The operating panel shall contain the following controls and buttons:

- a. Car floor buttons with 13 mm numbers corresponding to the floors served for registration of car calls. Call registered lights, located within or behind the buttons, shall illuminate the floor number corresponding to the call registered.
- b. An illuminating alarm button shall be provided at the bottom of each car station to ring a bell located in the hoistway near the main lobby and on top of the car.
- c. Provide an illuminating intercom call button. Actuating the intercom call button shall activate the control center panel intercom distress signal. The call button light shall flash for 10-20 seconds once the intercom call is answered.
- d. A red emergency stop switch shall be provided at the bottom of each car station to interrupt the power supply independently of the regular operating devices. The switch shall be so arranged that when operated, it will sound the alarm bell as described above and activate the control center panel intercom distress signal. The actuation of this switch shall not cancel registered calls. Alternately, the stop switch may be installed in the car service panel.
- e. A door open button, which shall stop the closing motion of the doors and return them automatically to their fully open position. This button shall be effective while the car is at a landing and until the car starts into motion, regardless of any special operational features (except firefighters' service).
- f. Provide an extended time, door hold open button with an internal registration light in the main car-operating panel on the service

elevators to increase the normal door open time (automatic operation) to 10-20 seconds for cart transfer. Registration or re-registration of a car call shall cancel this hold open time and the registration light.

- g. One Firefighters' service key switch, door close button, light jewel, buzzer, and call cancel button.
- h. One sound-powered telephone jack.
- i. One security card reader in specified elevators (provided by others).
- j. A service panel with a heavy-duty, vandal-resistant, hinged, lockable, door matching the front return panel finishes or faceplates shall be mounted below the main car operating station.

The service panel shall contain the following controls with each control and its operating positions identified by engraved and black filled letters:

- 1) A door protection light ray cutout switch to disconnect the light rays from the door closing circuit.
- 2) An inspection (hand) service switch for disconnecting all automatic operation, limiting the car speed, and making the appropriate hoistway access switch operable, when the car is at the top or bottom terminal, conforming to the ASME A17.1 Code.
- 3) Car lighting ON and OFF Switch.
- 4) An emergency lighting "test" button to activate the car emergency lights.
- 5) A 4-position (off, low, medium, high speeds) car exhaust fan switch.
- 6) CCTV security camera on/off switch.
- 7) An independent service selection switch to permit the selection of independent or automatic operation.

- 8) Attendant service operating lights, chimes and “up”, “down”, and “pass” and “door control” buttons for service elevators.
  - 9) A start button for closing the doors and starting the elevator when operating on independent service. Alternately, the car floor pushbuttons may be used for this function.
  - 10) A 220 volt, 1 phase, 50-hertz 13A duplex power outlet.
- O. Car Top Control Station: Provide stations as per Code.
- P. Emergency Exits: Provide car top emergency access exits, car side exits (if required), and contacts as per Code.
- Q. Work Light and Duplex Plug Receptacle: Provide on the top and the bottom of the elevator car lights with an on/off switch and wire lamp guards.

## **2.9 CAR ENCLOSURES**

- A. Passenger Elevators: Elevator car enclosure shall be manufactured as per code. The interior side and rear wall finishes, the car ceiling, the car handrails and lighting, and car flooring finished materials and features are to be as below: (Passenger Elevators P1 – P3)
1. Wall Finish: Stainless Steel panels in finish as per Architects choice.
  2. Floor Finish: Granite as per Architects choice.
  3. Car Doors: Stainless steel finish as per Architects choice.
  4. Ceiling: Stainless Steel in decoration finish with concealed lighting as approved by Architect
  5. Front Return Panels and Integral Entrance Columns: Provide patterned and mirrored polished stainless steel finish as approved by Architect. The entire units are to swing on concealed hinges or pivots for access to integral car station wiring and fixtures. Secure in closed position with concealed 3-point latch. Provide cabinets with flush doors for service controls and cutouts for pushbuttons, etc.

6. Transom: Stainless steel with finish as approved by Architect
7. Shell: Reinforced U.S. 14 gauge furniture steel side and rear walls with baked enamel interior finish, top and side exits (if required). Shell base is to contain concealed ventilation cutouts on the side and rear walls. Apply sound-deadening mastic to exterior.
8. Top: Reinforced U.S. 12 gauge furniture steel with hinged, lockable exit and baked enamel finish.
9. Ventilation: 3-speed, exhaust fan with a diffuser and exhaust and intake port screens. The fan shall exhaust the car air into the hoistway.
10. CCTV Security Cameras: Install color CCTV security cameras provided by the building contractor concealed in the elevator dropped ceilings and positioned to view the complete elevator car interiors and the car position indicator. Provide shielded wire pairs or coaxial cables from each CCTV camera run to the lift machine room junction boxes.

## **2.10 CONTROL AND SIGNAL FIXTURES**

- A. Pushbuttons: Provide the Passenger elevator groups with touch button controls as specified in Elevator Schedules, flush mounted. Provide standard, finished stainless steel fixtures mounted with vandal-resistant screws at all typical floors. Each fixture shall include touch buttons for each direction of travel, which illuminate to indicate call registration.
- B. Hoistway Access Switches: Mount without faceplates in entrance frame side jamb at all top floors and bottom floors where walk-in pits are not provided.
- C. Firefighters' Switch and Box: Mount in central Fire Command Center and identify purposes with permanent engraving. Provide flush-mounted box with lockable hinged cover as directed by the local Fire Department to contain keys and instructions for emergency use of elevators. Box faceplate material to be similar to fire command console faceplate and contain engraved legend, EMERGENCY ONLY in 13 mm high letters.
- D. Interactive Elevator Monitoring System: Provide a microprocessor-based, interactive elevator monitoring and control system E.M.S. that will permit



elevator data acquisition and control. Provide consoles, containing 40 cm color S.V.G.A. or LCD monitors (1 per group), interactive keyboards, central processing computers, 12-giga byte hard disk storage device, an 8.8 cm floppy disk, 1.44 M byte C.D. disk drive, graphic cards, serial communication data links, laser printers, power supplies, driver cards and complete wiring. The consoles shall be located in the command center control panel and shall be provided with a synchronous communications to each elevator group's performance, elevator status, tabular display, security features, elevator on-off functions, elevator control functions, elevator parameter functions, performance monitoring, fault diagnostics, traffic analysis and report generation. The interactive elevator parameter functions shall include the capability to change the lobby loading sign floor selections, elevator acceleration/deceleration values and jerk rates, the elevator door dwell times, the hall lantern pre and post-call activation times, elevator energy conservation, security car and hall call lock offs, up peak, down peak, bypass, attendant service selections, standby power applications, etc., from the console keyboards. The E.M.S. keyboard shall be used to program or change messages displayed on the car position indicators and the lobby loading displays.

- E. Command Center Control (Security Room) and Indicator Panels (Include All Elevators):
1. Provide communication and E.M.S. control items such as a master intercom station, car-to-lobby commands, floor lock-off/override commands, intercom selection switches, bypass/loading lights, standby power selection features, car on and off commands, attendant service selections, pilot lights, etc., located in a flush-mounted panel with lockable, hinged door(s).
  2. Provide discrete car position and travel direction displays, and hall call group waiting light displays, on color 40 cm SVGA or LCD monitors, standby power status indicators, car operating light, etc., in an exposed faceplates of the same material and as a component part of the control panels.
  3. Engrave and fill the panel faceplates with operating instructions for all controls. Provide all conduits and wiring to the control panels.

4. Provide and install the console to enclose all Command Center control panel items provided by the Elevator Contractor. Console to be of a type similar to that provided by Security Contractor for the building equipment located in the Command Center, Finish to be baked enamel on steel or plastic laminate equipped with a stainless steel faceplate.

F. Car Position Indicators:

1. Passenger Elevators: Dual color, 250mm, LCD or LED display screens mounted in each car swing front return panel. The position indicators shall display the travel direction and floor position of the elevator in the hoistway at all times.
  - a. The passenger elevator LCD or LED display system consisting of screens, necessary control hardware and links to the Elevator Monitoring System (EMS), shall be provided for each car. The screens shall be protected by clear plastic lenses and shall be readable over a wide viewing angle.
  - b. Car position and direction, operational messages, directory information messages for each floor, and discretionary messages shall be displayed on the screen. The upper part of the screen shall be reserved for car position and direction, which shall be displayed at all times. All messages shall be displayed on the lower part of the screen, with space for four lines of approximately 18 characters per line; only one message shall be displayed at a time.
  - c. Up to eight discretionary messages, created in the EMS, shall be downloaded from it to the display at a one time. A duration shall be assigned for each of the discretionary messages so that they are displayed, one after another, for the time intervals specified. Up to 128 directory messages shall be similarly downloaded. When the car has committed to stop at a floor, a directory message shall be displayed overriding any discretionary message. While the car doors are open, the directory message shall continue to be displayed and triangle indicating the car's direction shall move up and down. When the car doors close, the directory message shall disappear. The current time, date and outside temperature and wind speed shall be displayed for a brief fixed period if so commanded through

EMS, then the interrupted discretionary message shall be displayed again until its specified duration has been completed. An operational message shall be displayed whenever required, overriding both directory and discretionary messages.

- d. Up to ten custom floor labels for position indication, to be displayed instead of default values, shall be created and downloaded through the E.M.S. Display of the discretionary and directory messages shall be turned on and off from the E.M.S. Should the link to E.M.S. or the E.M.S. itself fail, all information other than directory and discretionary messages and time shall continue to be displayed in the normal manner. The outside temperature shall be measured by means of a temperature probe supplied and mounted by the Elevator Contractor or by a temperature signal provided by the B.M.S. Contractor.
- G. Hall Lanterns: Provide direction signals illuminating white for up and red for down, located adjacent to each hoistway entrance at indicated landings. Provide hall lanterns as approved by Architect from Manufacturer's different options, equipped with polished stainless steel (passenger elevators) or brushed stainless steel faceplates mounted with tamperproof screws at typical levels. Lantern shall illuminate indicating the direction of travel and chime sound (once for up direction, twice for down direction) approximately 4 seconds before the arriving car's doors open. Provide the Passenger Elevators with fixed-car assignment (prediction) type hall lanterns and car selections so that the appropriate hall lantern is lighted and its chime sounded within 2 second of hall call registration. As the responding car approaches the landing, the lantern shall signal the elevator's final arrival by pulsing the hall lantern and resounding the chime for the departure direction.
- H. Engineering Indicator Panel: Provide indicator panel, EMS, LCD or ports to accept portable monitors in each elevator machine room as part of, or adjacent to, the group supervisory control panel. As a minimum, the display shall be capable of providing the following:
  1. Waiting passenger indicators for each floor.

2. Position and direction indicators for each elevator.
3. Control function indicators and keyboards normally provided to assist maintenance and adjuster personnel to verify correct operation, program, and trouble-shoot the system.

## 2.11 COMMUNICATION SYSTEMS

- A. General: Provide Audio Intercom system for all Elevators including all equipment. Provide all wiring and conduits between elevator hoistways and the intercom stations. The system shall contain the following stations:

Station Location	Station Type	Selection Buttons To Call
All Elevator Control Panels	Master	Elevator Car, Command Center Panel (Security Room)
Command Center Panel (Security Room)	Master	Elevator Control Panel, All Elevator Car
All Elevator Cars	Slave	Command Center Panel (Security Room)

1. Basic Equipment: The system shall contain the following equipment:
  - a. A solid-state amplifier including preamplifier of appropriate rating shall provide voice transmission with adequate volume and a minimum of distortion at each station in the system.
  - b. Master stations shall contain the following:
    - 1) Speaker, microphone and a handset for 2-way communication.
    - 2) Selection buttons to enable communication with the master and slave stations as listed above. When a selected button is depressed, continual reception from that station shall be maintained.
    - 3) A two-position talk-receive button: Press to talk, release to receive.
    - 4) "In use" light to be illuminated when any master station is being used.

- 5) Reset button shall reset the station selection buttons and switch off the "in use" light, making the system available for use by any master station.
- 6) A volume control knob for adjustment of incoming volume.
- 7) A button to establish communications with all other stations in the elevator system simultaneously, command center panel.
- 8) A distress light consisting of a separate light fixture for each elevator, shall be illuminated when the alarm button or emergency stop switch in the elevator car is actuated. This light shall be provided in the master station in the command center panel. A buzzer shall sound whenever a distress light is illuminated.
- 9) Both the distress light and buzzer shall remain energized until the intercom selection button for that car has been depressed at the command center to indicate communication.
- 10) A slave station in each elevator car, shall consist of a microphone and speaker or transceiver-speaker combination located above the car dropped ceiling. The car remote speakers shall be mounted in the car canopy and be equipped with a protective grille.

Provide an illuminating intercom call button in each car.

Provide a selection switch in the command center control panel for making the lobby control master intercom station active or inactive.

## 2. Station Housings:

- a. The master station in the machine rooms shall be housed in a metal cabinet of baked enamel finish attached to the group elevator supervisory control panel or wall mounted. Provide a handset with 7.5m long cord.
- b. The command center master intercom shall be provided with stainless steel faceplates with engraved and filled operating instructions. Coordinate faceplates and installation of units with the Console

Manufacturer. Provide each master station with a handset, equipped with a 3m long cord.

## **2.12 ELEVATOR SEISMIC DESIGNS AND EMERGENCY OPERATIONS**

Seismic Designs: The Elevator Contractor shall prepare and submit all required equipment seismic design calculations, reactions, and supporting information on the shop drawing as per ASME A17.1-2005. Provide all required seismic designs, restraints, guards, tie downs and operations for Zone 2B.

Calculations shall indicate the vertical and horizontal seismic design loads, for all operating and control equipment and the rail loads. Calculations shall bear the stamp of a licensed Structural Engineer.

## **PART 3 – EXECUTION**

### **3.1 SITE CONDITIONS AND INSPECTION**

- A. Prior to beginning the installation of equipment, examine the hoistway and machine room areas and verify that no irregularities exist that would affect quality of execution of work as specified. Particularly, note:
  1. Hoistway size and plumbness.
  2. Sill supports and pockets.
  3. Support areas for brackets, beams, etc.
  4. Building and divider beams.
- B. Notify the Main Contractor if any discrepancies exist in the building work that will prevent the installation of the elevator equipment.
- C. Scaffolding for installation of hoist way equipment and any special hoist way equipment or special scaffolding required is to be arranged by Elevator Contractor.
- D. Separator beams in hoist way shall be provided by Elevator Contractor as per requirement.

### **3.2 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials in Manufacturer's original, unopened protective packaging.
- B. Store materials in original protective packaging. Prevent soiling, physical damage or wetting.
- C. Protect equipment and exposed finishes during transportation, erection and construction period against damage and stains.

### **3.3 INSTALLATION**

- A. Install each equipment item in accordance with accepted Manufacturer's direction, referenced codes and specifications.
- B. Install machine room equipment with clearances complying with referenced codes and specifications.
- C. Install items so that they may be removed by portable hoists or other means for maintenance and/or repair.
- D. Install items so that access for maintenance is safe and readily available.
- E. Install equipment to afford maximum safety and continuity of operation after a seismic acceleration.
- F. Add equipment identification numerals.

### **3.4 FIELD QUALITY CONTROL**

- A. Work at the jobsite will be checked during the course of installation. Full cooperation with these Inspectors is mandatory. Any corrective work they require shall be accomplished prior to performing further installation dependent upon or related to the required correction.
- B. Have Code Authority acceptance inspection performed. Verification that such tests have been completed, all corrective work accomplished and installation approved for issuance of a permit to operate shall be required before acceptance of any unit.

### **3.5 ADJUSTMENTS**

- A. Align guide rails vertically within a tolerance of 1.6mm in 30 m. Secure joints without gaps and file any irregularities to a smooth surface.
- B. Balance cars after the final car installations to equalize pressure of roller guide shoes on rails.
- C. Lubricate all equipment in accordance with Manufacturer's instructions.
- D. Adjust motors, power converters, brakes, and controllers, leveling switches, limit switches, stopping switches, door operators, interlocks and safety devices to achieve required performance levels.
- E. Fabricate and assemble the various parts in the shop insofar as practical to minimize field assembly. Parts, which cannot be shop, assembled or require close field fit shall be trial assembled in the shop and marked for field erection.

### **3.6 CLEANUP AND TOUCHUP**

- A. Keep work areas orderly and free from debris during progress of project.
- B. Remove all loose materials and filings resulting from this work from hoistway surfaces.
- C. Clean machine room equipment and floor of dirt, oil and grease.
- D. Clean hoistway, car, car enclosures, entrances, operating and signal fixtures, and trim of dirt, oil, grease and finger marks.
- E. Touchup all minor scratches, dings or imperfections in finished materials and painted surfaces that are exposed to public view.

### **3.7 ACCEPTANCE INSPECTIONS AND TEST**

- A. General: Final acceptance of the installation shall be made only after all field quality control inspections and tests are complete, all submittals and certificates have been received and the Owner's Representative satisfied that the following have been satisfactorily completed:
  - 1. Workmanship and equipment comply with specification.



2. Contract speed, capacity and floor-to-floor performance comply with specification.
  3. Performance of following is satisfactory:
    - a. Starting, accelerating, running.
    - b. Decelerating, leveling, stopping.
    - c. Door operation and closing force.
- B. Personnel, Equipment and Instruments: Furnish personnel, equipment and instruments to perform required tests. The following instruments may be necessary to complete the tests:
1. Test weights.
  2. Multi meter.
  3. 500-volt Megger.
  4. Alternating-current voltmeter and ammeter.
  5. Stop watch.
  6. Celsius-calibrated thermometers (4 minimum on traction elevator test).
  7. Precision tachometer.
  8. Spring scale for door-force test.
  9. Decibel meter for noise test.
  10. 3-axis recording accelerometer for vibration, car sway and car ride test.
- C. Traction Elevators:
1. Insulation-Resistance Test: Test safety circuit, door lock circuit, loop circuit, and motor and generator field circuits at 500 volts. Minimum resistance to ground shall be 1 megohm.

2. Running Test: With equipment within 5°C of ambient machine room temperature, the following shall be accomplished:
  - a. Insert thermometers in hoist motor field coil windings. (Shield with cotton waste).
  - b. Check floor-to-floor performance time, speed, stopping accuracy and general ride of elevator with no load, balanced load and full load in car.
  - c. Run fully loaded car continuously for a period of one hour with a minimum of 150 starts, stopping at each floor in both directions for a period of 10 seconds.
  - d. At the end of the test, again check floor-to-floor performance time, stopping accuracy and general ride with full load, balanced load and no load in car.
- 3 Test Results:
  - a. In all test conditions speed and performance times specified shall be met, stopping accuracy shall be maintained without releveling and general riding quality shall be acceptable to the Owner's Representative.
  - b. Temperature rise in windings shall not exceed 50° Celsius above ambient.
- D. Performance Guarantee: Should these tests develop any defects or poor workmanship, any variance or noncompliance with the requirements of the specified codes and/or ordinances or any variance or noncompliance with the requirements of these specifications, the following work and/or repairs shall be completed at no expense to the Owner.
  1. Replace all equipment that does not meet Code or specification requirements.
  2. Perform all work and furnish all materials and equipment necessary to complete the specified operation and/or performance.

3. Perform all retesting required by the governing Code Authority and the Owner to verify the specified operation and/or performance.

### **3.8 OWNER'S INFORMATION**

- A. Submittals: Provide written information and equipment necessary for proper maintenance and adjustment of the equipment prior to final acceptance, as follows:
  1. Single-line wiring diagram of as-installed elevator circuits with index of location and function of all components. Mount installation diagrams on masonite panels or hang bound sets in racks and leave on the job. Provide three final corrected sets, one copy, CD (computer disc) within 90 days after job acceptance for the Owner's file.
  2. Lubrication instructions, including recommended grade of lubricants.
  3. Parts catalogs for all replaceable parts including ordering forms and instructions.
  4. Complete operating and maintenance instructions for all controls and switches provided.
  5. Five sets of keys to operate each type of key switch provided.
  6. Any special maintenance or trouble shooting tools or devices required for maintenance on all elevators.

### **3.9 OWNER'S PERSONNEL TRAINING**

- A. Train designated Owner's elevator operating, safety and security personnel (3 persons) to operate all elevator systems, intercoms, card readers, E.M.S. Systems, security keyboards, elevator operations, emergency systems and car operating panel controls etc.
- B. Provide all required training information, videos, CD ROMs, manuals, training classes, and training personnel to the provide Owner's personnel with training knowledge, and information on how to operate all of the elevator interface functions and controls.

**3.10 WARRANTY INSPECTION**

- A. At least 30 days prior to warranty expiration, schedule final inspection and retest with Owner's Representative. Requirements shall include close examination of all equipment.
- B. Replace, repair or adjust any equipment found defective and covered by warranty prior to expiration of warranty period.

**End of Section**

**3.12 WELDING**

- A. Shop welding will be permitted in lieu of screwed or flanged connection.
- B. Joining of section of welded piping in the field shall be by screwed, flanged or mechanical joints as specified. Field welding shall not be permitted.
- C. Welded fittings shall be in compliance with ANSI standard for factory made Wrought steel butt welded fittings ANSI No. B16.9, ANSI standard butt welding ends or pipes, Valves, flanges and fittings ANSI No. B16.25 and ASTM Standard, specification for piping fitting for wrought carbon steel and alloy steel for moderate elevated temperatures ASTM No. A-234
- D. Tee connection in welded pipes shall be made with factory fabricated butt welded Tee or with welded of butt, socket or threaded type. When welded are used the branch connections shall be  $\frac{1}{2}$  of the diameter of less. Scarf welding or direct butt welding of side connection shall not be permitted.
- E. Tees fabricated from pipe shall not be permitted.
- F. Long radius, welding elbow shall wherever possible, be used in changing pipe direction of welded pipe lines. Mitered joints shall not be accepted.
- G. Welders shall be certified as being qualified for welding in compliance with the requirements of ASME boilers and pressure vessel code Section IX qualification standard for welding and brazing procedures, welder's and welding and brazing operators, latest edition.

**END OF SECTION**