BUILDING INTERIOR WORKS FOR EXTENSION OF PIEDMC HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE

Contract # PIE/P&C/HO/25/32

BIDDING DOCUMENTS
VOLUME-I

June 2025

SUMMARY OF VOLUMES

Bidding Documents comprises of four (04) Volumes as described, as under:

VOLUME-I
INVITATION FOR BIDS

INSTRUCTIONS TO BIDDERS

BID DATA SHEET

LETTER OF FINANCIAL BID,

AND APPENDICES TO BID

FORMS

PART I GENERAL CONDITIONS OF CONTRACT

PART II SPECIAL CONDITIONS OF CONTRACT

SPECIAL PROVISIONS

VOLUME-II
BILL OF QUANTITIES

VOLUME-III
TECHNICAL SPECIFICATIONS

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INVITATION
FOR BIDS

INVITATION FOR BIDS

Date: _____

Bid Reference No.: PIE/P&C/HO/25/32

Punjab Industrial Estates Development and Management Company (PIEDMC) is a company set up under section 42 of the Companies Act 2017, owned by the Government of the Punjab to facilitate and accelerate the industrial growth of Punjab, Pakistan.

1. PIEDMC intends to hire a Contractor for Building interior works for extension of PIEDMC head office at Sundar Industrial Estate.

2. Sealed Bids are invited for the above said work from Contractors registered with PEC in category C-4 or above and specialized codes CE10, EE04 & EE11 having experience of similar works.

3. Bidding will be conducted under the provision of PPRA Rules -2014 (amended up to date) on single stage one envelope basis

4. For bids submission on E-procurement, Bidders are requested to register at www.punjab.eprocure.gov.pk.
5. Bidding Documents are available on PPRA website: www.ppra.punjab.gov.pk, PIEDMC website www.pie.com.pk and EPADS Portal **i.e.** http://punjab.eprocure.gov.pk free of cost.

6. **The Bidding documents, completed, signed, stamped must be submitted online E-Pak Acquisition and Disposal System (EPADS) Portal i.e.** http://punjab.eprocure.gov.pk **till 3rd July, 2025 by or before 03:00 PM and bids shall be opened at same date on 03:30 PM, as per the PPRA Rules, 2014**

7. Bid must contain Bid Security in shape of Bank Guarantee / CDR / Bank Draft / Pay Order amounting to Rs. 1,431,383/- in favor of "PIEDMC" (which is 2% of the estimated cost), without which the offer shall be rejected being non-responsive. The bid security must be attached in PDF format and submitted in original in Chief Engineer (P&C) office before bid submission date and time.

8. Bids that are incomplete, not signed and stamped, late, or submitted by other than specified mode will not be considered.
9. In case, the firm is found Black-listed by PIEDMC and PPRA or provide false / misleading information, it's Bid will be cancelled and will be recommended for punitive action.

Note: PIEDMC management may reject all bids or proposals at any time prior to the acceptance of bids or proposals, as provided under Rule-35 of Punjab Procurement Rules, 2014 (amended from time to time)

Yours faithfully,

Chief Engineer (Planning &Contracts)

INSTRUCTIONS
TO
BIDDERS

INSTRUCTIONS TO BIDDERS

(Note: These Instructions to Bidders along with Bid data sheet 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 Employer as defined in the Bid data sheet hereinafter called "the Employer" wishes to receive bids for the construction and completion of works and remedying any defects therein as described in these Bidding Documents, and summarized in the Bid data sheet hereinafter referred to as the "Works".

1.2 The successful bidder will be expected to complete the Works within the time specified in Appendix-A to Bid.

IB.2 Source of Funds

2.1 The Employer has applied for/received a loan/credit/scheme from the source (s) indicated in the Bid data sheet in Pak Rupees/ various currencies towards the cost of the project specified in the Bid data sheet and it is intended that the proceeds of this loan/credit/ scheme will be applied to eligible payments under the Contract for which these Bidding Documents are issued.

IB.3 Eligible Bidders

3.1 This Invitation for Bids is open to all bidders meeting the following requirements:

a. Duly licensed by the Pakistan Engineering Council (PEC), PEC License must be valid in the category C-4 or Above with specialization codes of CE-10, EE-04 & EE-11.
b. A Bidder shall have the nationality of Islamic Republic of Pakistan. A Bidder shall be deemed to have the nationality of Pakistan if the Bidder is constituted, incorporated and operates in conformity with the provisions of the laws of Pakistan.
c. A Bidder must be on Active Taxpayer List of the Federal Board of Revenue and Punjab Revenue Authority at the time of submission of its Bid.
d. The Bidder do not appear in the list of debarred/blacklisted firms and individuals on the website of Punjab Procurement Regulatory Authority (PPRA).
e. Must have at least 05 years experience of works of similar nature and complexity. (Documentary evidence to be attached)
f. Minimum two (02) projects of similar size and nature in last five (05) years related to Construction of Building Works etc valuing more than Rs. 50 million. (Documentary evidence to be attached)
g. Project having amounting less than PKR 50 million shall not be considered
h. Bidders shall provide evidence of their eligibility with their Bids satisfactory to the Employer.

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

B. BIDDING DOCUMENTS

IB.7 Contents of Bidding Documents

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

1. Instructions to Bidders.
2. Bid data sheet.
3. General Conditions of Contract, Part-I (GCC).
4. Special Conditions of Contract, Part-II (SCC).
5. Specifications – Special Provisions.
6. Specifications – Technical Provisions.
7. Form of Bid & Appendices to Bid, including a Certificate that the bidder is not currently blacklisted by the Procuring Agency.
8. Bill of Quantities (Appendix-D to Bid).
9. Form of Bid Security.
10. Form of Contract Agreement.
11. **Forms of Performance Security, Mobilization Advance Bank Guarantee and Secured Advance.**
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 prospective bidder requiring any clarification (s) in respect of the Bidding Documents may notify the Employer in writing at the Employer's address indicated in the Invitation for Bids. The Employer will respond to any request for clarification which he receives **prior** to the deadline for submission of bids. The exact number of days will be mentioned in the Bid Data Sheet keeping in view the time given for submission of bids.
Copies of the Employer's response will be forwarded to all purchasers of the Bidding Documents, including a description of the enquiry but without identifying its source.

IB.9 Amendment of Bidding Documents

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

9.2 Any addendum thus issued shall be part of the Bidding Documents pursuant to IB 7.1 hereof and shall be communicated to all bidders, **at least three (03) days prior to the closing date of submission of the bid.** Prospective bidders shall acknowledge receipt of each addendum in writing to the Employer through EPADS portal.

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

C. PREPARATION OF BIDS

IB.10 Language of Bid

10.1 The bid and all correspondence and documents related to the bid exchanged by a bidder and the Employer shall be in the bid language stipulated in the Bid data sheet and Special 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 Comprising the Bid

11.1 The Bid shall comprise two envelopes submitted simultaneously, one called the Technical Bid and the other the Financial Bid, containing the documents listed in Bid data sheet under the heading of IB 11.1 A & B respectively. Both envelopes to be enclosed together in an outer single envelope called the Bid. Each bidder shall furnish all the documents as specified in Bid data sheet 11.1 A & B.

11.2 In case of Joint Venture (JV), JV of any kind is not allowed to participate in the bid.

(a) In case of a successful bid, the Form of JV Agreement shall be signed so as to be legally binding on all partners within 7 days of the receipt of letter of acceptance failing which the contract and the letter of acceptance shall stand void and redundant.

(b) One of the joint venture partners shall be nominated as being in charge/ lead partner; 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/ lead partner shall always be duly authorized to deal with the Employer regarding all matters related with and/or incidental to the execution of Works as per the terms and Conditions of JV Agreement 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 JV Agreement (in case of a successful bid); and

(e) A copy of JV agreement shall be submitted before signing of the Contract, stating the conditions under which JV 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. The JV Agreement shall be made part of the contract. No amendments / modifications whatsoever in the joint venture agreement shall be agreed to between the joint venture partners without prior written consent of the Employer.

Not Applicable

11.3 The Bidder shall furnish, as part of the Technical Bid, a Technical Proposal including a statement of work methods, equipment, personnel, schedule, **qualification/ experience required to successfully execute the individually assigned tasks** and any other information as stipulated in Bidding Forms, in sufficient detail to demonstrate the adequacy of the Bidders' proposal to meet the work requirements 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 IB 1.1 hereof, based on the unit rates and / or prices submitted by the bidder.

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 Employer when executed and shall be deemed covered by rates and prices for other items in the Bill of Quantities.

12.3 All duties, taxes and other levies payable by the Contractor under the Contract, or for any other cause, as on the date **of opening of the bids** shall be included in the rates and prices and the total Bid Price submitted by a bidder.

Additional / reduced duties, taxes and levies due to subsequent additions or changes in legislation shall be reimbursed / deducted as per Sub-Clause 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 the 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 Employer's country (referred to as the "Foreign Currency Requirements") shall indicate the same in Appendix-B to Bid. However, subject to GCC clause 71.1, payments in foreign currency are not permissible.

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 **of opening of the bids.** For the purpose of payments, the exchange rates used in bid preparation shall apply for the duration of the Contract. Rule 32(2) of PPR-14 shall be applicable for rate of exchange of foreign currencies.

IB.14 Bid Validity

14.1 Bids shall remain valid for the period stipulated in the Bid data sheet 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 Employer 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 or 180 days whichever is more. 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. Rule 28 of PPR-14 shall be applicable for Bid Validity period.

IB.15 Bid Security

15.1 Each bidder shall furnish, as part of his bid, a Bid Security in the amount stipulated in the Bid data sheet in Pak Rupees or an equivalent amount in a freely convertible currency.

15.2 The Bid Security shall be, at the option of the bidder, in the form of Deposit at Call or a Bank Guarantee issued by a Scheduled Bank in Pakistan or from a foreign bank duly counter guaranteed by a Scheduled Bank in Pakistan in favor of the Employer valid for a period 30 days beyond the Bid Validity date.

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

15.4 The bid securities of unsuccessful bidders will be returned as promptly as possible, after expiry of grievance period or disposal of complaint if any, complying with the relevant provisions of PPR-14.

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 IB 22.1;
(b) If the bidder does not accept the correction of his Bid Price pursuant to IB 27.2 hereof; or
(c) In the case of successful bidder, if he fails within the specified time limit to:
  (i) Furnish the required Performance Security;
  (ii) Sign the Contract Agreement, or
  (iii) Furnish the required JV agreement within 7 days of the receipt of letter of acceptance.

IB.16 Alternate Proposals by Bidder

16.1 No alternate proposals are allowed in single stage two envelope method.

IB.17 Pre-Bid Meeting (N/A)

17.1 The Employer may, on his own motion or at the request of any prospective bidder(s), hold a pre-bid meeting to clarify issues and to answer any questions on matters related to the Bidding Documents. The date, time and venue of pre-bid meeting, if convened, is as stipulated in the Bid data sheet. All prospective bidders or their authorized representatives shall be invited to attend such a pre-bid meeting.

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

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 of the Bidding Documents listed in IB 7.1 hereof, which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause IB.9 and not through the minutes of the pre-bid meeting.

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 Letter of Financial 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 Financial Bids and Technical Bids 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 The Bidder shall prepare one original of the Technical Bid and one original of the Financial Bid comprising the Bid as described in Bid data sheet against IB 11 and clearly mark it "ORIGINAL - TECHNICAL BID" and "ORIGINAL - FINANCIAL BID". In addition, the Bidder shall submit two (2) copies of the Bid and clearly mark each of them "COPY." In the event of any discrepancy between the original and the copies, the original shall prevail. (N/A)

18.5 The original and all copies of the Bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified in the Bid data sheet and shall be attached to the bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Bid, except for unamended printed literature, shall be signed or initialed by the person signing the bid.

18.6 Any amendments such as interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the bid.

18.7 Bidders shall indicate in the space provided in the Letter of Technical and Financial Bids, 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. (Bids shall be submitted through EPADS portal)

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

D. SUBMISSION OF BIDS FOR SINGLE STAGE ONE ENVELOPE BIDDING PROCEDURE

IB.19 Sealing and Marking of Bids

19.1 Each bidder shall submit his bid as under:

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

(b) The envelopes containing the ORIGINAL and copies will be put in one sealed envelope and addressed / identified as given in IB 19.2 hereof. (Bids shall be submitted through EPADS portal)

(c) The technical bid should comprise of documents listed in IB11.1 (A) & the Financial Bid should comprise of documents listed in IB 11.1 (B) which shall be placed in separate envelopes in accordance with IB 11.1. (N/A)

19.2 The inner and outer envelopes shall: (Bids shall be submitted through EPADS portal)

(a) Be addressed to the Employer at the address provided in the Bid data sheet;

(b) Bear the name and identification number of the contract as defined in the Bid data sheet; and

(c) Provide a warning not to open before the time and date for bid opening, as specified in the Bid data sheet.

19.3 In addition to the identification required in IB 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 Employer will assume no responsibility for the misplacement or premature opening of the Bid.

IB.20 Deadline for Submission of Bids

20.1 (a) Bids must be received by the Employer at the address specified no later than the time and date stipulated in the Bid data sheet.

(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.

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

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

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

IB.21 Late Bids

21. (a) Any bid received by the Employer 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 determine the manner in which timely delivery of his bid will be accomplished either in person, by messenger or by mail.

IB.22 Modification, Substitution and Withdrawal of Bids

22.1 Any bidder may modify**,** substitute or withdraw his bid after bid submission provided that the modification, substitution or written notice of withdrawal is received by the Employer 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 IB 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 FOR SINGLE STAGE ONE ENVELOPE BIDDING PROCEDURE

IB. 23 Bid Opening

The Employer shall open the bids through EPADS portal.

23.1 The Employer will open the Technical Bids in public at the address, date and time specified in the Bid data sheet in the presence of Bidders` designated representatives and anyone who choose to attend. The Financial Bids will remain unopened and will be held in custody of the Employer until the specified time of their opening.

23.2 First, envelopes marked "WITHDRAWAL" shall be opened and read out and the envelope with the corresponding bid shall not be opened, but returned to the Bidder. No bid withdrawal shall be permitted unless the corresponding Withdrawal Notice contains a valid authorization to request the withdrawal and is read out at bid opening.

23.3 Second, outer envelopes marked "SUBSTITUTION" shall be opened. The inner envelopes containing the Substitution Technical Bid and/or Substitution Financial Bid shall be exchanged for the corresponding envelopes being substituted, which are to be returned to the Bidder unopened. Only the Substitution Technical Bid, if any, shall be opened, read out, and recorded. Substitution Financial Bid will remain unopened in accordance with IB 23.1. No envelope shall be substituted unless the corresponding Substitution Notice contains a valid authorization to request the substitution and is read out and recorded at bid opening.

Not Applicable

23.4 Next, outer envelopes marked "MODIFICATION" shall be opened. No Technical Bid and/or Financial Bid shall be modified unless the corresponding Modification Notice contains a valid authorization to request the modification and is read out and recorded at the opening of Technical Bids. Only the Technical Bids, both Original as well as Modification, are to be opened, read out, and recorded at the opening. Financial Bids, both Original and Modification, will remain unopened in accordance with IB 23.1. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.

23.5 Other envelopes holding the Technical Bids shall be opened one at a time, and the following read out and recorded:

(a) the name of the Bidder;
(b) whether there is a modification or substitution;
(c) the presence of a Bid Security, if required; and
(d) Any other details as the Employer may consider appropriate.

No Bid shall be rejected at the opening of Technical Bids except for late bids, in accordance with IB 21.1. Only Technical Bids read out and recorded at bid opening, shall be considered for evaluation.

Preliminary Examination of Technical Bids

23.6 a) The Employer shall first examine qualification and experience Data as per appendix M and N submitted by the Bidder. The technical proposal examination of those bidders only shall be taken in hand who meet the minimum requirement as mentioned in appendix M and N. Only substantially responsive qualification shall be considered for further evaluation.

b) The Employer shall examine the Technical Bid to confirm that all the documents have been provided, and to determine the completeness of each document submitted.

23.7 The Employer shall confirm that all the documents and information have been provided for evaluation of Technical bid as required under these bidding documents.

23.8 At the end of the evaluation of the Technical Bids, the Employer will invite only those bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified for award to attend the opening of the Financial Bids.

The date, time, and location of the opening of Financial Bids will be advised in writing by the Employer. Bidders shall be given reasonable notice for the opening of Financial Bids.

Not Applicable
Not Applicable

23.9 The Employer will notify Bidders in writing who have been rejected on the grounds of their Technical Bids being substantially non-responsive to the requirements of the Bidding Document and return their Financial Bids unopened as per rule 38(2)(a)(vii) of PPR-14.

23.10 The Employer shall conduct the opening of Financial Bids of all Bidders who submitted substantially responsive Technical Bids, publically in the presence of Bidders` representatives who choose to attend at the address, date and time specified by the Employer. The Bidder's representatives who are present shall be requested to sign a register evidencing their attendance.

Not Applicable

23.11 All envelopes containing Financial Bids shall be opened one at a time and the following read out and recorded:

(a) The name of the Bidder;
(b) Whether there is a modification or substitution;
(c) The Bid Prices, including any discounts; and
(d) Any other details as the Employer may consider appropriate.

Only Financial Bids and discounts, read out and recorded during the opening of Financial Bids shall be considered for evaluation. No Bid shall be rejected at the opening of Financial Bids.

23.12 If this Bidding Document allows Bidders to quote separate prices for different contracts, and the award to a single Bidder of multiple contracts, the methodology to determine the lowest evaluated price of the contract combinations is that which is most economical to the Employer.

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 final bid evaluation report which shall be done at least 10 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 (if applicable), final evaluated prices and recommendations against all the bids evaluated. Any effort by a bidder to influence the Employer'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 not later than ten 10 days after the announcement of Technical and Financial Bids. No bidder will be allowed to file grievance petition w.r.t. Technical Evaluation after announcement/ uploading of Financial Evaluation Report. 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 Employer 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 Employer in the evaluation of the bids in accordance with Clause IB.28.

25.2 If a Bidder does not provide clarifications of its Bid by the date and time set in the Employer's request for clarification, its bid may be rejected. Rule 33 of PPR-14 shall be applicable for clarifications.

IB.26 Examination of Bids and Determination of Responsiveness

26.1 Prior to the detailed evaluation of bids, the Employer 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; (iv) includes signed Integrity Pact where required as per clause IB.35; and (v) conforms to all the terms, conditions and specifications of the Bidding Documents, without material deviation or reservation (vi) meets the qualification criteria as specified in Appendix-M & N. 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 Employer's rights or the bidder's obligations under the Contract; (iii) adoption/rectification whereof would affect unfairly the competitive position of other bidders presenting substantially responsive bids. Only substantially responsive bid shall be considered for further evaluation.

26.3 If a bid is not substantially responsive, it may not subsequently be made responsive by correction or withdrawal of the non-conforming material deviation or reservation. The Employer may, however, seek confirmation/ clarification in writing which shall be responded in writing.

IB.27 Correction of Errors

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

(a) Where there is a discrepancy between the amounts in figures and in words, the amount in words will govern; 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 Employer 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 Letter of Financial Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and with the concurrence of the bidder, shall be considered as binding upon the bidder. If the bidder does not accept

the corrected Bid Price, his Bid will be rejected, and the Bid Security shall be forfeited in accordance with IB.15.6 (b) hereof.

IB.28 Evaluation and Comparison of Bids

28.1 The Employer 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 Employer 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 Day work; 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 the Bid of the successful bidder is seriously unbalanced in relation to the Employer's estimate of the cost of work to be performed under the Contract, the Employer 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 Employer 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 Employer against financial loss in the event of default of the successful bidder under the Contract.

F. AWARD OF CONTRACT

IB.29 Award

29.1 Subject to Clauses IB.30 and IB.34, the Employer 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 IB 29.2.

29.2 The Employer, at any stage of the bid evaluation, having credible reasons for or prima facie evidence of any defect in bidder's capacities, may require the bidders to provide information concerning their professional, technical, financial, legal or managerial competence whether already pre-qualified or not:

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

IB.30 Employer's Right to Accept any Bid and to Reject any or all Bids

30.1 Notwithstanding Clause IB.29, the Employer reserves the right to accept or reject any Bid by giving reasons, and to annul the bidding process and reject all bids, at any time prior to the acceptance of any bid or proposal, 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 Employer, the Employer will notify the successful bidder in writing ("Letter of Acceptance") that his Bid has been accepted. This letter shall name the sum which the Employer will pay the Contractor in consideration of the execution and completion of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Conditions of Contract called the "Contract Price").

31.2 No Negotiation with the bidder having evaluated as lowest responsive or any other bidder shall be permitted. However, the lowest evaluated bidder may further reduce the Bid Price voluntarily without compromising the quality/ quantity.

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

31.4 Upon furnishing by the successful bidder of a Performance Security, the Employer will promptly notify the other bidders that their Bids have been unsuccessful and return their bid securities. No bid security can be returned without exhausting the grievance period or without finally disposing off the complaint of the non-responsive bidder. However, bid security may be returned earlier if any bidder submits affidavit that he is satisfied with the proceedings and hence his bid security may be returned.

IB.32 Performance Security

32.1 The successful bidder shall furnish to the Employer a Performance Security in the form and the amount stipulated in the Bid data sheet and the Conditions of Contract within a period of 14 days after the receipt of Letter of Acceptance. On submission of Performance Security, the bid security of the successful bidder may be returned.

32.2 Failure of the successful bidder to comply with the requirements of IB.32.1 or IB.33 or IB.35 shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security. Rule 56 of PPR-14 shall be applicable for performance Security.

IB.33 Signing of Contract Agreement

33.1 Within 14 days from the date of furnishing of acceptable Performance Security under the Conditions of Contract, the Employer 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 Employer and the successful bidder shall be executed within 14 days of the receipt of the Contract Agreement by the successful bidder from the Employer.

IB. 34 General Performance of the Bidders

The Employer reserves the right to obtain information regarding performance of the bidders on their previously awarded contracts/works. The Employer may in case of consistent poor performance of any Bidder as reported by the employers of the previously awarded contracts, interalia, reject his bid and/or refer the case to the concerned forum(s). Upon such reference, the concerned forum(s) in accordance with its rules, procedures and relevant laws of the land take such action as may be deemed appropriate under the circumstances of the case including black listing of such Bidder and debarring him from participation in future bidding for similar works.

IB.35 Integrity Pact

The Bidder shall sign and stamp the Integrity Pact provided at Appendix-L to Bid in the Bidding Documents for all 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. Submission of Bids shall be construed as evidence that the bidder has admitted all provisions of the Instruction to the Bidders.

IB.37 PPRA Act, 2009 and PPR-14 will have over-riding effect

PPRA Act, 2009 and PPR-14 as amended upto date will supersede and will have an over-riding effect in case in case of any contradiction with these Instructions, the Contract or any other part of the Bidding Documents.

BID DATA SHEET

BID DATA SHEET

The following specific data for the Works to be bid 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.

Clause Reference from Instructions to Bidders is given hereunder.

1.1 Name and address of the Employer:

Punjab Industrial Estates Development & Management Company (PIEDMC)
Attention:
Chief Executive Officer (CEO)
Commercial Area (North), Sundar Industrial Estates,
Sundar-Raiwind Road, Lahore
Tel: 042-35297203-6
Fax: 042-35297207

1.1 Name of the Project:

Name of the Project
"Building Interior Works for Extension of PIEDMC Head Office at Sundar Industrial Estate"

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

Employer's own resources.

2.1 Amount and type of financing:

All payments shall be made in Pak Rupees through Employer's own resources.

6 Site Visit

The text of Clause IB.6 is deleted and substituted with the following:

6.1 The Bidder or his authorized representative shall visit and inspect the Site of Works including the areas and surroundings to be used for Contractor's information from his own sources which may be necessary for the purpose of preparing the bid. The Employer may assist but will not take any responsibility for the supply or correctness of the information.

6.2 The Bidder shall, before submitting his bid, satisfy himself in all respects including the following:

(i) The existing facilities in the vicinity of the Site of Works, the hydrological, hydrogeological and climatological conditions, the form and nature of the Site of Work.

(ii) The quantities and nature of the Works and materials necessary for completion of the Works.
(iii) The means of access to the Site of Works and exit from the Site.
(iv) The available accommodation on land for Contractor's Camp within or outside the Site of Works.
(v) All necessary information as to risks, contingencies and other circumstances, which may influence or affect the bid.
(vi) The existing condition at the Site.

6.3 The Bidder shall also enquire and satisfy himself as to the source, the quantity of supply, the sufficiency of and the means of obtaining and transporting all plant, material, labor, fuel, water, electricity, and other matters or things required for or in connection with the Works.

6.4 In preparing the Bid, the Bidder shall also consider his obligation to adequately store all materials and maintain existing facilities and all Temporary Works during the period of their usage.

6.5 The Bidder must make local inquiries as to the physical conditions prevailing at the Site and obtain his own information on all matters and things that may in any way influence him in making a bid and fixing the rates in the Bill of Quantities. He must also satisfy himself as to the risks, obligations and responsibilities to be undertaken in accordance to the Contract to be entered into by him should his bid be accepted.

6.6 The Bidder shall make his own investigations, enquiries and assessments, on all matters, of all conditions of existing constructions at the site and its vicinity, to his satisfaction before submitting his bid.

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

8.1 Clarification of Bidding Documents

The text of Sub-Clause IB.8.1 is deleted and substituted with the following:

Clarifications regarding the Bidding Documents should be requested through EPADS portal at least 7 days prior to the deadline for submission of bids, and the responses will be uploaded on EPADS portal. The Employer will within three (3) working days after receiving the request for clarification, respond through EPADS portal to any request for clarification.

9 Amendment of Bidding Documents

9.1 In last line, after the word 'addendum', the words "through EPADS portal" are added.

9.2 In second line, delete the text reading as "and shall be communicated in writing to all purchasers of the Bidding Documents".

10.1 Bid language:

English

11 Documents Comprising the Bid

11.1 (A) The Bidder shall submit with its Technical Bid the following documents:

(a)	Bid Security	(IB.15)
(b)	Written confirmation authorizing the signatory of the Bid to commit the Bidder	(IB.18.5)
(c)	Documents required to be submitted under eligibility requirements	(IB.3.1)
(d)	Pending litigation information	
(e)	Special Stipulations	(Appendix –A)
(f)	Proposed Construction Schedule	(Appendix –E)
(g)	Method of Performing the Work	(Appendix –F)
(h)	Availability of Critical Equipment	(Appendix –G)
(i)	Construction Camp and Housing Facilities	(Appendix –H)
(j)	List of Sub-contractors (as required)	(Appendix –I)
(k)	Organization Chart for Supervisory Staff	(Appendix –K)
(l)	Integrity Pact	(Appendix –L)
(m)	Financial Competence and Access to financial Resources	(Appendix –M)
(n)	Past Performance, Qualification and Experience, Equipment	(Appendix –N)

(o) Any other documents required to be submitted with Technical Bid in accordance with these Bidding Documents.

11.1(B) The Bidder shall submit with its Financial Bid the following documents:

(a)	Letter of Financial Bid	
(b)	Foreign Currency Requirements (Not Used)	(Appendix –B)
(c)	Price Adjustment under Clause 70	(Appendix –C)
(d)	Bill of Quantities	(Appendix –D)
(e)	Estimated Progress Payments	(Appendix –J)

12 Bid Prices

Following Sub-Clause is added at the end of Clause IB.12.

a) The Bidder, by the act of submitting a bid, acknowledges that he has inspected the Site of Works and determined the general characteristics and conditions. The Employer will not assume any responsibility for information, interpretations and deductions the bidder may make from the information furnished by the Employer or the Engineer. No verbal agreement or conversation with any officer, employee or agent of the Employer or the Engineer shall affect or modify any of the terms or obligations contained in the Bidding Documents.

b) The attention of the Bidder is drawn to the fact that local regulations require special formalities to be complied with in connection with the ordering, purchasing and importing of materials from outside Pakistan. Bidder will be deemed to have obtained full information about all such matters and to have allowed in his bid for all delays, additional costs and financing charges that may arise directly or indirectly there from.

c) Any neglect or failure on the part of the Bidder to obtain reliable information on the spot or elsewhere upon the foregoing or any other matters affecting the execution and completion of the Works, the rates, total amounts and the Contract shall not relieve the Bidder whose bid is accepted from any risks or liabilities or from the responsibility of completing and handing over the Works.

d) The rates and prices set down by the Bidder against all the items in the Bill of Quantities are to be the full inclusive value of the finished work described there under and shall be deemed to include all costs of performing the Works including all taxes and duties (except Provincial Sales Tax which shall be shown as separate line item at the end of summary cost), profits and costs of accepting the general risks, liabilities and obligations of every kind set forth or implied in the Bidding Documents.

13 Currencies of Bid and Payment

13.1 The text of Sub-Clause IB.13.1 is deleted and substituted with the following:

The unit rates and prices shall be quoted by the Bidder entirely in Pak Rupees. All payments under the Contract shall be made in Pak Rupees only.

A Bidder expecting to incur expenditures in other currencies for inputs to the Works supplied from outside the Employer's country shall bear all costs and risks for arranging such currencies including currency exchange rate parity.

13.2 The Sub-Clause is deleted in its entirety.

14.1 Period of Bid Validity:

Period of Bid Validity is one hundred twenty (120) days after the Date of Technical Bid Opening.

15.1 Amount of Bid Security:

Amount of Bid Security shall be Pak Rs. 1,431,383/- in favour of "Punjab Industrial Estates Development & Management Company (PIEDMC)" (which is 2% of estimated cost).

17 Pre-Bid Meeting

17.1 Venue, time, and date of the pre-Bid meeting:

There will be no pre-bid meeting

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

The Bidder shall submit PDF copy of its Original Bid through EPADS portal.

19 Sealing and Marking of Bids

19.2(a) Employer's address for the purpose of Bid submission:

Bid shall be submitted through EPADS portal only.

19.2(b) Name and Number of the Contract:

"*Building Interior Works for Extension of PIEDMC Head Office at Sundar Industrial Estate*"
Contract # PIE/P&C/HO/25/32

20.1 Deadline for submission of Bids

The text of Sub-Clause IB.20.1 (a) is deleted and substituted with the following:

Bid shall be submitted through EPADS portal not later than the time and date stipulated in Invitation for Bids.

22 Modification, Substitution and Withdrawal of Bids

The text of Clause IB.22 is deleted and substituted with the following:

Any bidder may modify**,** substitute or withdraw his bid through EPADS portal prior to the deadline for submission of bids.

23.1 Bid Opening

Sub-Clauses IB.23.1 to 23.4 are deleted.

The text of Sub-Clause IB.23.5 is deleted and substituted with the following:

The text of Sub-Clauses IB.23.8 to 23.12 are deleted and substituted with the following:

At the end of the evaluation of Bids, the Employer will notify the result through EPADS portal.

25 Clarification of Bids

The request for clarification will be uploaded through EPADS portal, and bidders will submit the required information via EPADS portal.

29 Award

29.2 First paragraph of Sub-Clause IB.29.2 is deleted and substituted with the following:

The Employer, at any stage of the bid evaluation, having credible reasons for or prima facie evidence of any defect in bidder's capacities, may require the bidders to provide information concerning their professional, technical, financial, legal or managerial competence whether already declared substantially responsive.

30.1 Employer's Right to Accept any Bid and to Reject any or all Bids

The text "to accept or reject any Bid by giving reasons, and to annul the bidding process and reject all bids," is replaced by "to annul the bidding process and reject all Bids
Following new paragraph is added at the end of Sub-Clause IB.30.1:

Besides above, the Employer reserves the right to reject any Bid on the accounts including but not limited to the following:

If at any time, it is found that a material misrepresentation of facts is made or the information submitted by the Bidder concerning his qualification was false or materially inaccurate or incomplete. If any partner of JV is involved in misrepresentation of facts as stated above, then the entire JV shall be disqualified/rejected.

32.1 Standard form and amount of Performance Security acceptable to the Employer:

Form and amount of performance Security is stated in the Conditions of Contract.

Letters of
Financial Bid,
and
Appendices to Bid

Letter of Financial Bid

Date: .....

Bid Reference No: PIE/P&C/HO/25/32

To:

Chief Executive Officer (CEO)
Punjab Industrial Estates Development and Management Company (PIEDMC)
Sundar Industrial Estate,
Sundar-Raiwind Road, Lahore

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (IB) 9;

(b) The total price of our Bid, excluding any discounts offered in item (c) below is:……..…

(c) The discounts offered and the methodology for their application are:……..

(d) Our Bid shall be valid for a period of …….. days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(e) If our Bid is accepted, we commit to obtain a Performance Security in accordance with the Bidding Documents;

(f) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed and we do hereby declare that the Bid is made without any collusion, comparison of figures or arrangement with any other bidder for the Works.

(g) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.

(h) We agree to permit Employer or its representative to inspect our accounts and records and

other documents relating to the bid submission and to have them audited by auditors. This permission is extended for verification of any information provided in our Technical Bid which comprises all documents enclosed herewith in accordance with IB.11.1 of the Bid data sheet.

(i) If awarded the Contract, the person named below shall act as Contractor's Representative.

Name .....

In the capacity of .....

Signed .....

Duly authorized to sign the Bid for and on behalf of .....

Date .....

Address……..

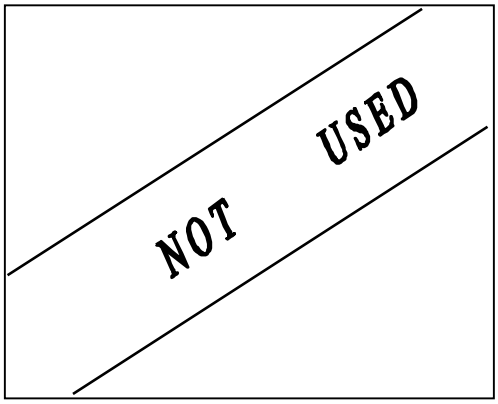
SPECIAL STIPULATIONS

Clause
Conditions of Contract

1.	Engineer's Authority to issue Variation	2.1 (b) (viii)(b)	Up to 1% of the Contract Price for each variation and accumulatively up to 5% of the Contract Price for all variations.
2.	Law applicable	5.1(b)	The relevant laws applied in the Province of Punjab.
3.	Amount of Performance Security	10.1	5% of Contract Price stated in the Letter of Acceptance.
4.	Time for Furnishing Programme	14.1	Within seven (07) days from the date of receipt of Letter of Acceptance.
5.	Minimum amount of Third Party Insurance	23.2	Pak Rs. 2,000,000 per occurrence with number of occurrences unlimited.
6.	Time for Commencement	41.1	Within seven (07) days from the date of receipt of Engineer's Notice to Commence which shall be issued within seven (07) days after signing of Contract Agreement.
7.	Time for Completion	43.1, 48.2	04 months from the date of receipt of Engineer's Notice to Commence.
8.	a) Amount of Liquidated Damages	47.1	0.1% for each day of delay in completion of the Works subject to a maximum of 10% of Contract Price stated in the Letter of Acceptance.
9.	Defects Liability Period	49.1	365 days from the effective date of Taking Over Certificate.
10.	Percentage of Retention Money	60.2	7% of the amount of Interim Payment Certificate.
11.	Limit of Retention Money	60.2	5 % of Contract Price stated in the Letter of Acceptance.
12.	Minimum amount of Interim Payment Certificates (Running Bills)	60.2	20% of Contract Price
13.	Time of Payment from delivery of Engineer's Interim Payment Certificate to the Employer.	60.10	30 days

14.	Mobilization Advance (Interest Free)	60.13	10 % of Contract Price as stated in the Letter of Acceptance in two parts in accordance with Sub-Clause 60.13 of Special Conditions at the discretion of Employer

FOREIGN CURRENCY REQUIREMENTS



PRICE ADJUSTMENT UNDER CLAUSE 70 OF CONDITIONS OF CONTRACT

Please refer to Clause 70 of Particular Conditions of Contract for details.

BD-1

Appendix-D to Bid

BILL OF QUANTITIES

Please refer to Volume-II of Bidding Documents

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 Employer's completion target stipulated in Appendix-A to Bid and counted from the date of receipt of Engineer's Notice to Commence (Attach sheets as required for the specified form of Construction Schedule):

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:

b. 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.

4. Quality control / Quality assurance measures to be adopted including procedures to be followed for carrying out all tests required under specifications.

LIST OF MAJOR EQUIPMENT – RELATED ITEMS

The Bidder will provide a list of all major equipment and related items **(refer paragraph C of Appendix-N to Bid)**, 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.

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**
b. Owned						
b. To be Purchased						
b. To be arranged on Lease						

Equipment:

The Bidder must demonstrate that it has the key equipment (**refer paragraph C of Appendix-N to Bid**) listed hereafter:

No.	PLANT/EQUIPMENT				
	Equipment Type and Characteristics	**Total Nos. available**	**Under Utilization on other projects, if applicable**	**Nos. waiting to be shifted to new project(s)**	**Min. Number Required for this Project**
1					
2					
3					
4					
5					
6					

CONSTRUCTION CAMP AND HOUSING FACILITIES

The Contractor in accordance with Clause 34 of the Conditions of Contract 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:

b. 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.). The Contractor should mention here what are his proposed environmental measures for the project as per EPA rules like treatment of wastewater and water quality etc. The Contractor shall submit a detailed EMP (Environmental Management Plan) to describe how materials are removed from site and disposed off at a safe location, prevention for the contamination of ground and surface water in neighboring areas etc. including remedial measures for adoption.

6. Detail of testing Lab with testing equipment 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.

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

Note: The aggregate amount of parts of the Works proposed to be subcontracted shall not exceed the percentage of the Contract Price stipulated in Sub-Clause 4.1 of Special Conditions.

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:

Quarter	**Amounts (In %age of Bid Price)**
1	**2**
1st Quarter	
2nd Quarter	
3rd Quarter	
4th Quarter	
5th Quarter	
6th Quarter	
7th Quarter	
8th Quarter	
Bid Price	

BK-1

Appendix-K to Bid

ORGANIZATION CHART

FOR THE SUPERVISORY STAFF AND LABOUR

[The Bid shall enclose the following separately for construction and Defects Liability Periods:

1. Organization chart for the head office control.

2. Organization chart for the Site control.

3. A Schedule of administrative and technical supervisory to be appointed at Site with their proposed period of stay at site.

4. A Schedule of technical supervisory staff.]

BL-1
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: As per Financial Bid
Contract Title: _____

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

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

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

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

Notwithstanding any rights and remedies exercised by GoPb in this regard, [name of Contractor] agrees to indemnify GoPb for any loss or damage incurred by it on account of its corrupt business practices and further pay compensation to GoPb in an amount equivalent to ten time the sum of any commission, gratification, bribe, finder's fee or kickback given by [name of Contractor] as aforesaid for the purpose of obtaining or inducing the procurement of any contract, right, interest, privilege or other obligation or benefit in whatsoever form from GoPb.

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

BM-1

Appendix-M to Bid

PAST PERFORMANCE, QUALIFICATION AND EXPERIENCE, EQUIPMENT

A. Experience in Contracts of Similar Size and Nature

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	Lead Partner	
Minimum two (02) projects of similar nature and complexity completed over last 5-years, each amounting not less than PKR 50 Million. Both projects shall have been executed in Pakistan.	Must meet requirement	**N/A**	**N/A**	**N/A**	Form EXP-1 with attachments

Notes:

(i) Project having amounting less than PKR 50 million shall not be considered.

(ii) The Road works, dam, irrigation canals and telecom projects will not be considered as "similar nature" projects. However, Construction of Building works will be considered.

(iii) The projects shall have been executed as a prime contractor for public/government sector only.

(iv) The Bidder shall submit authenticated documentary evidence which include Taking Over Certificate/Completion Certificate of the contracts being claimed under above mentioned criteria.

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

Each Bidder must fill this form.

Fill out one (1) form per contract.

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

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

FORMS

BID SECURITY
PERFORMANCE SECURITY
CONTRACT AGREEMENT
MOBILIZATION ADVANCE GUARANTEE

BID SECURITY
(Bank Guarantee)

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 'Employer') 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 Employer; and

WHEREAS, the Employer 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 Employer, conditioned as under:

(1) that the Bid Security shall remain in force up to and including the date 30 days after the deadline for validity of bids as stated in the Instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Surety is hereby waived;

(2) that the Bid Security of unsuccessful Bidders will be returned by the Employer 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 Employer 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 therefore, on the prescribed form presented to him for signature enter into a formal Contract with the said Employer in accordance with his Bid as accepted and furnish within fourteen (14) days of his being requested to do so, a Performance Security with good and sufficient surety, as may be required, upon the form prescribed by the said Employer for the faithful performance and proper fulfilment of the said Contract or in the event of non-withdrawal of the said Bid within the time specified for its validity then this obligation shall be void and of no effect, but otherwise to remain in full force and effect.

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

PROVIDED ALSO THAT the Employer shall 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 Employer forthwith and without any reference to the Principal (Bidder) or any other person.

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

SURETY (Bank)

WITNESS:

Signature _____

1. _____

Name _____

_____

Title _____

Corporate Secretary (Seal)

Corporate Guarantor (Seal)

2. _____

_____

Name, Title & Address

FORM OF PERFORMANCE SECURITY
(Bank Guarantee)

Guarantee No._____
Executed on _____
Expiry date _____

[Letter by the Guarantor to the Employer]

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 Employer) in the penal sum of the amount stated above for the payment of which sum well and truly to be made to the said Employer, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has accepted the Employer'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 Employer, 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 defences under the Contract, do hereby irrevocably and independently guarantee to pay to the Employer without delay upon the Employer's first written demand without cavil or arguments and without requiring the Employer to prove or to show grounds or reasons for such demand any sum or sums up to the amount stated above, against the Employer'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 Employer's designated Bank & Account Number.

PROVIDED ALSO THAT the Employer 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 Employer 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 "Employer") of the one part and _____
(hereafter called the "Contractor") of the other part.

WHEREAS the Employer 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 / Clarification as agreed or otherwise, if any, except those parts relating to Instructions to Bidders shall be deemed to form and be read and construed as part of this Contract, viz:

   (a) The Contract Agreement;
   (b) The Letter of Acceptance;
   (c) The completed Form of Bid (Technical & Financial);
   (d) Special Stipulations (Appendix-A to Bid);
   (e) The Special Conditions of Contract – Part II;
   (f) The General Conditions – Part I;
   (g) The priced Bill of Quantities (Appendix-D to Bid)
   (h) The completed Appendices to Bid (B, C, E to N);
   (i) The Drawings;
   (j) The Specifications; and
   (k) (any other).

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

4. The Employer hereby covenants to pay the Contractor, in consideration of the execution and completion of the Works as per provisions of the Contract, the Contract Price or such other 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	Signature of Employer
_____	_____
(Seal)	(Seal)

Signed, Sealed and Delivered in the presence of:

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

MG-1

MOBILIZATION ADVANCE GUARANTEE
(Unconditional Bank Guarantee)

Guarantee No._____ Date _____

WHEREAS _____(hereinafter called the 'Employer') has entered into a Contract for _____
(Particulars of Contract)
with _____ (hereinafter called the "Contractor').

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

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

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

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

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

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

[Notes on the Conditions of Contract]

The Conditions of Contract comprise two parts:

(a) Part I - General Conditions of Contract
(b) Part II - Special Conditions of Contract

Over the years, a number of "model" General Conditions of Contract have evolved. Assistance has been obtained for the one used in these Standard Bidding Documents from the International Federation of Consulting Engineers (Federation Internationale des Ingenieurs-Conseils, or FIDIC), making the same compatible with the PPRA, Act, 2009 and the PPR-14.

PART I
GENERAL CONDITIONS

CONDITIONS OF CONTRACT

FOR WORKS OF CIVIL

ENGINEERING CONSTRUCTION

[This Contract is based on FIDIC 1987 Conditions of Contract]

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PART I - GENERAL CONDITIONS

Definitions and Interpretation

1.1 **Definitions**

In the Contract (as hereinafter defined) the following words and expressions shall have the meanings hereby assigned to them, except where the context otherwise requires:

(a) (i) "Employer" means the person named as such in Part II of these Conditions and the legal successors in title to such person, but not (except with the consent of the Contractor) any assignee of such person.

(ii) "Contractor" means the person whose tender has been accepted by the Employer and the legal successors in title to such person, but not (except with the consent of the Employer) any assignee of such person.

(iii) "Subcontractor" means any person named in the Contract as a Subcontractor for a part of the Works or any person to whom a part of the Works has been subcontracted with the consent of the Engineer and the legal successors in title to such person, but not any assignee of any such person.

(iv) "Engineer" means the person appointed by the Employer to act as Engineer for the purposes of the Contract and named as such in Part II of these Conditions.

(v) "Engineer's Representative" means a person appointed from time to time by the Engineer under Sub-Clause 2.2.

(b) (i) "Contract" means these Conditions (Parts I and II), the Specification, the Drawings, the Bill of Quantities, the Tender, the Letter of Acceptance, the Contract Agreement (if completed) and such further documents as may be expressly incorporated in the Letter of Acceptance or Contract Agreement (if completed).

(ii) "Specification" means the specification of the Works included in the Contract and any modification thereof or addition thereto made under Clause 51 or submitted by the Contractor and approved by the Engineer.

(iii) "Drawings" means all drawings, calculations and technical information of a like nature provided by the Engineer to the Contractor under the Contract and all drawings, calculations, samples, patterns, models, operation and maintenance manuals and other technical information of a like nature submitted by the Contractor and approved by the Engineer.

(iv) "Bill of Quantities" means the priced and completed bill of quantities forming part of the Tender.

(v) "Tender" means the Contractor's priced offer to the Employer for the execution and completion of the Works and the remedying of any defects therein in accordance with the provisions of the Contract, as accepted by the Letter of Acceptance.

(vi) "Letter of Acceptance" means the formal acceptance by the Employer of the Tender.

(vii) "Contract Agreement" means the contract agreement (if any) referred to in Sub-Clause 9.1.

(viii) "Appendix to Tender" means the appendix comprised in the form of Tender annexed to these Conditions.

(c) (i) "Commencement Date" means the date upon which the Contractor receives the notice to commence issued by the Engineer pursuant to Clause 41.

(ii) "Time for Completion" means the time for completing the execution of and passing the Tests on Completion of the Works or any Section or part thereof as stated in the Contract (or as extended under Clause 44) calculated from the Commencement Date.

(d) (i) "Tests on Completion" means the tests specified in the Contract or otherwise agreed by the Engineer and the Contractor which are to be made by the Contractor before the Works of any Section or part thereof are taken over by the Employer.

(ii) "Taking-Over Certificate" means a certificate issued pursuant to Clause 48.

(e) (i) "Contract Price" means the sum stated in the Letter of Acceptance as payable to the Contractor for the execution and completion of the Works and the remedying of any defects therein in accordance with the provisions of the Contract.

(ii) "Retention Money" means the aggregate of all monies retained by the Employer pursuant to Sub-Clause 60.2(a).

(iii) “Interim Payment Certificate” means any certificate of payment issued by the Engineer other than the Final Payment Certificate.

(iv) “Final Payment Certificate” means the certificate of payment issued by the Engineer pursuant to Sub-Clause 60.8.

(f) (i) "Works" means the Permanent Works and the Temporary Works or either of them as appropriate.

(ii) "Permanent Works" means the permanent works to be executed (including Plant) in accordance with the Contract

(iii) "Temporary Works" means all temporary works of every kind (other than Contractor's Equipment) required in or about the execution and completion of the Works and the remedying of any defects therein.

(iv) "Plant" means machinery, apparatus and the like intended to form or forming part of the Permanent Works.

(v) "Contractor's Equipment" means all appliances and things of whatsoever nature (other than Temporary Works) required for the execution and completion of the Works and the remedying of any defects therein, but does not include Plant, materials or other things intended to form or forming part of the Permanent Works.

(vi) "Section" means a part of the Works specifically identified in the Contract as a Section.

(vii) "Site" means the places provided by the Employer where the Works are to be executed and any other places as may be specifically designated in the Contract as forming part of the Site.

(g) (i) "cost" means all expenditure properly incurred or to be incurred, whether, on or off the Site, including overhead and other charges properly allocable thereto but does not include any allowance for profit.

(ii) "day" means calendar day.

(iii) "foreign currency" means a currency of a country other than that in which the Works are to be located.

(iv) "writing" means any hand-written, type-written, or printed communication, including telex, cable and facsimile transmission.

1.2 **Headings and Marginal Notes**

The headings and marginal notes in these Conditions shall not be deemed part thereof or be taken into consideration in the interpretation or construction thereof or of the Contract.

1.3 **Interpretation**

Words importing persons or parties shall include firms and corporations and any organization having legal capacity. Interpretation by PPRA shall be final w.r.t. the legal provisions. The PPRA Act, 2009 and the PPR-14 shall supersede the provisions/ text in this document in case of any conflict.

1.4 **Singular and Plural**

Words importing the singular only also include the plural and vice versa where the context requires.

1.5 **Notices, Consents, Approvals, Certificates and Determinations**

Wherever in the Contract provision is made for the giving or issue of any notice, consent, approval, certificate or determination by any person, unless otherwise specified such notice, consent, approval, certificate or determination shall be in

writing and the words "notify", "certify or "determine" shall be construed accordingly. Any such consent, approval, certificate or determination shall not unreasonably be withheld or delayed.

Engineer and Engineer's Representative

2.1 Engineer's Duties and Authority

(a) The Engineer shall carry out the duties specified in the Contract.

(b) The Engineer may exercise the authority specified in or necessarily to be implied from the Contract, provided, however, that if the Engineer is required, under the terms of his appointment by the Employer, to obtain the specific approval of the Employer before exercising any such authority, particulars of such requirements shall be set out in Part II of these Conditions. Provided further that any requisite approval shall be deemed to have been given by the Employer for any such authority exercised by the Engineer.

(c) Except as expressly stated in the Contract, the Engineer shall have no authority to relieve the Contractor of any of his obligations under the Contract.

2.2 Engineer's Representative

The Engineer's Representative shall be appointed by and be responsible to the Engineer and shall carry out such duties and exercise such authority as may be delegated to him by the Engineer under Sub-Clause 2.3.

2.3 Engineer's Authority to Delegate

The Engineer may from time to time delegate to the Engineer's Representative any of the duties and authorities vested in the Engineer and he may at any time revoke such delegation. Any such delegation or revocation shall be in writing and shall not take effect until a copy thereof has been delivered to the Employer and the Contractor.

Any communication given by the Engineer's Representative to the Contractor in accordance with such delegation shall have the same effect as though it had been given by the Engineer. Provided that:

(a) any failure of the Engineer's Representative to disapprove any work, materials or Plant shall not prejudice the authority of the Engineer to disapprove such work, materials or Plant and to give instructions for the rectification thereof; and

(b) if the Contractor questions any communication of the Engineer's Representative he may refer the matter to the Engineer who shall confirm, reverse or vary the contents of such communication.

2.4 Appointment of Assistants

The Engineer or the Engineer's Representative may appoint any number of persons to assist the Engineer's Representative in the carrying out of his duties under Sub-

Clause 2.2. He shall notify to the Contractor the names, duties and scope of authority of such persons. Such assistants shall have no authority to issue any instructions to the Contractor save in so far as such instructions may be necessary to enable them to carry out their duties and to secure their acceptance of materials, Plant or workmanship as being in accordance with the Contract, and any instructions given by any of them for those purposes shall be deemed to have been given by the Engineer's Representative.

2.5 **Instructions in Writing**

Instructions given by the Engineer shall be in writing, provided that if for any reason the Engineer considers it necessary to give any such instruction orally, the Contractor shall comply with such instruction. Confirmation in writing of such oral instruction given by the Engineer, whether before or after the carrying out of the instruction, shall be deemed to be an instruction within the meaning of this Sub-Clause. Provided further that if the Contractor, within 7 days, confirms in writing to the Engineer any oral instruction of the Engineer and such confirmation is not contradicted in writing within 7 days by the Engineer, it shall be deemed to be an instructions of the Engineer.

The provisions of this Sub-Clause shall equally apply to instructions given by the Engineer's Representative and any assistants of the Engineer or the Engineer's Representative appointed pursuant to Sub-Clause 2.4.

2.6 **Engineer to Act Impartially**

Wherever, under the Contract, the Engineer is required to exercise his discretion by:
(a) giving his decision, opinion or consent,
(b) expressing his satisfaction or approval,
(c) determining value, or
(d) otherwise taking action which may affect the rights and obligations of the Employer or the Contractor

He shall exercise such discretion impartially within the terms of the Contract and having regard to all the circumstances. Any such decision, opinion, consent expression of satisfaction, or approval, determination of value or action may be opened up, reviewed or revised as provided in Clause 67.

Assignment and Subcontracting

3.1 **Assignment of Contract**

The Contractor shall not, without the prior consent of the Employer (which consent, notwithstanding the provisions of Sub-Clause 1.5, shall be at the sole discretion of the Employer), assign the Contract or any part thereof, or any benefit or interest therein or thereunder, otherwise than by:

(a) a charge in favour of the Contractor's bankers of any monies due or to become due under the Contract, or

(b) assignment to the Contractor's insurers (in cases where the insurers have discharged the Contractor's loss or liability) of the Contractor's right to obtain relief against any other party liable.

4.1 Subcontracting

The Contractor shall not subcontract the whole of the Works. Except where otherwise provided by the Contract, the Contractor shall not subcontract any part of the Works without the prior consent of the Engineer. Any such consent shall not relieve the Contractor from any liability or obligation under the Contract and he shall be responsible for the acts, defaults and neglects of any Subcontractor, his agents, servants or workmen as fully as if they were the acts, defaults or neglects of the Contractor, his agents servants or workmen.

Provided that the Contractor shall not be required to obtain such consent for:

(a) the provision of labour,

(b) the purchase of materials which are in accordance with the standards specified in the Contract,

(c) the subcontracting of any part of the Works for which the Subcontractor is named in the Contract.

4.2 Assignment of Subcontractors' Obligations

In the event of a Subcontractor having undertaken towards the Contractor in respect of the work executed, or the goods, materials, Plant or services supplied by such Subcontractor, any continuing obligation extending for a period exceeding that of the Defects Liability Period under the Contract, the Contractor shall at any time, after the expiration of such Period, assign to the Employer, at the Employer's request and cost, the benefit of such obligation for the unexpired duration thereof.

Contract Documents

5.1 Language/s and Law

There is stated in Part II of these Conditions:

(a) the language or languages in which the Contract documents shall be drawn up, and

(b) the country or state the law of which shall apply to the Contract and according to which the Contract shall be construed.

If the said documents are written in more than one language, the language according to which the Contract shall be construed and interpreted is also stated in Part II of these Conditions, being therein designated the "Ruling Language". Interpretation by PPRA shall be final w.r.t. the legal

provisions. The PPRA Act, 2009 and the PPR-14 shall supersede the provisions/ text in this document in case of any conflict.

5.2 Priority of Contract Documents

The several documents forming the Contract are to be taken as mutually explanatory of one another, but in case of ambiguities or discrepancies the same shall be explained and adjusted by the Engineer who shall thereupon issue to the Contractor instructions thereon and in such event, unless otherwise provided in the Contract, the priority of the documents forming the Contract shall be as follows:

(a) The Contract Agreement;
(b) The Letter of Acceptance;
(c) The completed Form of Bid (Technical & Financial);
(d) Special Stipulations (Appendix-A to Bid);
(e) The Special Conditions of Contract – Part II;
(f) The General Conditions – Part I;
(g) The priced Bill of Quantities (Appendix-D to Bid)
(h) The completed Appendices to Bid (B, C, E to O);
(i) The Drawings;
(j) The Specifications; and
(k) (any other).

6.1 Custody and Supply of Drawings and Documents

The Drawings shall remain in the sole custody of the Engineer, but two copies thereof shall be provided to the Contractor free of charge. The Contractor shall make at his own cost any further copies required by him. Unless it is strictly necessary for the purposes of the Contract, the Drawings, Specification and other documents provided by the Employer or the Engineer shall not, without the consent of the Engineer, be used or communicated to a third party by the Contractor. Upon issue of the Defects Liability Certificate, the Contractor shall return to the Engineer all Drawings, Specification and other documents provided under the Contract.

The Contractor shall supply to the Engineer four copies of all Drawings, specification and other documents submitted by the Contractor and approved by the Engineer in accordance with Clause 7, together with a reproducible copy of any material which cannot be reproduced to an equal standard by photocopying. In addition the Contractor shall supply such further copies of such Drawings, Specification and other documents as the Engineer may request in writing for the use of the Employer, who shall pay the cost thereof.

6.2 One Copy of Drawings to be Kept on Site

One copy of the Drawings, provided to or supplied by the Contractor as aforesaid, shall be kept by the Contractor on the Site and the same shall at all reasonable times be available for inspection and use by the Engineer and by any other person authorised by the Engineer in writing.

6.3 Disruption of Progress

The Contractor shall give notice to the Engineer, with a copy to the Employer, whenever planning or execution of the Works is likely to be delayed or disrupted unless any further drawing or instruction is issued by the Engineer within a reasonable time. The notice shall include details of the drawing or instruction required and of why and by when it is required and of any delay or disruption likely to be suffered if it is late.

6.4 **Delay and Cost of Delay of Drawings**

If, by reason of any failure or inability of the Engineer to issue, within a time reasonable in all the circumstances, any drawing or instruction for which notice has been given by the Contractor in accordance with Sub-Clause 6.3, the Contractor suffers delay and/or incurs costs then the Engineer shall, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44, and

(b) the amount of such costs, which shall be added to the Contract Price, and shall notify the Contractor accordingly, with a copy to the Employer.

6.5 **Failure by Contractor to Submit Drawings**

If the failure or inability of the Engineer to issue any drawings or instructions is caused in whole or in part by the failure of the Contractor to submit Drawings, Specification or other documents which he is required to submit under the Contract, the Engineer shall take such failure by the Contractor into account when making his determination pursuant to Sub-Clause 6.4.

7.1 **Supplementary Drawings and Instructions**

The Engineer shall have authority to issue to 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 defects therein. The Contractor shall carry out and be bound by the same.

7.2 **Permanent Works Designed by Contractor**

Where the Contract expressly provides that part of the Permanent Works shall be designed by the Contractor, he shall submit to the Engineer, for approval:

(a) such drawings, specifications, calculations and other information as shall be necessary to satisfy the Engineer as to the suitability and adequacy of that design, and

(b) operation and maintenance manuals together with drawings of the Permanent Works as completed, in sufficient detail to enable the Employer to operate, maintain, dismantle, reassemble and adjust the Permanent Works incorporating that design. The Works shall not be considered to be completed for the purposes of taking over in accordance with Clause 48 until such operation and maintenance manuals together with drawings on completion have been submitted to and approved by the Engineer.

7.3 **Responsibility Unaffected by Approval**

Approval by the Engineer, in accordance with Sub-Clause 7.2, shall not relieve the Contractor of any of his responsibilities under the Contract.

General Obligations

8.1 **Contractor's General Responsibilities**

The Contractor shall, with due care and diligence, design (to the extent provided for by the Contract), execute and complete the Works and remedy any defects therein in accordance with the provisions of the Contract. The Contractor shall provide all superintendence, labour, material, Plant, Contractor's Equipment and all other things, whether of a temporary or permanent nature, required in and for such design, execution, completion and remedying of any defects, so far as the necessity for providing the same is specified in or is reasonably to be inferred from the Contract.

8.2 **Site Operations and Methods of Construction**

The Contractor shall take full responsibility for the adequacy, stability and safety of all Site operations and methods of construction. Provided that the Contractor shall not be responsible (except as stated hereunder or as may be otherwise agreed) for the design or specification of Permanent Works, or for the design or specification of any Temporary Works not prepared by the Contractor. Where the Contract expressly provides that part of the Permanent Works shall be designed by the Contractor, he shall be fully responsible for that part of such Works, notwithstanding any approval by the Engineer.

9.1 **Contract Agreement**

The Contractor shall, if called upon so to do, enter into and execute the Contract Agreement, to be prepared and completed at the cost of the Employer, in the form annexed to these Conditions with such modification as may be necessary.

10.1 **Performance Security**

If the Contract requires the Contractor to obtain security for his proper performance of the Contract, he shall obtain and provide to the Employer, such security within 30 days after the receipt of the Letter of Acceptance, in the sum stated in the Appendix to Tender. When providing such security to the Employer, the Contractor shall notify the Engineer of so doing. Such security shall be in the form annexed to these Conditions or in such other form as may be agreed between the Employer and the Contractor. The institution providing such security shall be subject to the approval of the Employer. The cost of complying with the requirements of this Clause shall be borne by the Contractor, unless the Contract otherwise provides.

10.2 **Period of Validity of Performance Security**

The performance security shall be valid until the Contractor has executed and completed the Works and remedied any defects therein in accordance with the

Contract. No claim shall be made against such security after the issue of the Defects Liability Certificate in accordance with Sub-Clause 62.1 and such security shall be returned to the Contractor within 14 days of the issue of the said Defects Liability Certificate.

10.3 **Claims under Performance Security**

Prior to making a claim under the performance security the Employer shall, in every case, notify the Contractor stating the nature of the default in respect of which the claim is to be made.

11.1 **Inspection of Site**

The Employer shall have made available to the Contractor, before the submission by the Contractor of the Tender, such data on hydrological and sub-surface conditions as have been obtained by or on behalf of the Employer from investigations undertaken relevant to the Works but the Contractor shall be responsible for his own interpretation thereof.

The Contractor shall be deemed to have inspected and examined the Site and its surroundings and information available in connection therewith and to have satisfied himself (so far as is practicable, having regard to considerations of cost and time) before submitting his Tender, as to:

(a) the form and nature thereof, including the sub-surface conditions,

(b) the hydrological and climatic conditions,

(c) the extent and nature of work and materials necessary for the execution and completion of the Works and the remedying of any defects therein, and

(d) the means of access to the Site and the accommodation he may require,

and, in general, shall be deemed to have obtained all necessary information, subject as above mentioned, as to risks, contingencies and all other circumstances which may influence or affect his Tender.

The Contractor shall be deemed to have based his Tender on the data made available by the Employer and on his own inspection and examination, all as aforementioned.

12.1 **Sufficiency of Tender**

The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Tender and of the rates and prices stated in the Bill of Quantities, all of which shall, except insofar as it is otherwise provided in the Contract, cover all his obligations under the Contract (including those in respect of the supply of goods, materials, Plant or services or of contingencies for which there is a Provisional Sum) and all matters and things necessary for the proper execution and completion of the Works and the remedying of any defects therein.

12.2 **Not Foreseeable Physical Obstructions or Conditions**

If, however, during the execution of the Works the Contractor encounters physical obstructions or physical conditions, other than climatic conditions on the Site, which obstructions or conditions were, in his opinion, not foreseeable by an experienced contractor, the Contractor shall forthwith give notice thereof to the Engineer, with a copy to the Employer. On receipt of such notice, the Engineer shall if in his opinion such obstructions or conditions could not have been reasonably foreseen by an experienced contractor, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44, and

(b) the amount of any costs which may have been incurred by the Contractor by reason of such obstructions or conditions having been encountered, which shall be added to the Contract Price,

and shall notify the Contractor accordingly, with a copy to the Employer. Such determination shall take account of any instruction which the Engineer may issue to the Contractor in connection therewith, and any proper and reasonable measures acceptable to the Engineer which the Contractor may take in the absence of specific instructions from the Engineer.

13.1 **Work to be in Accordance with Contract**

Unless it is legally or physically impossible, the Contractor shall execute and complete the Works and remedy any defects therein in strict accordance with the Contract to the satisfaction of the Engineer. The Contractor shall comply with and adhere strictly to the Engineer's instructions on any matter, whether mentioned in the Contract or not, touching or concerning the Works. The Contractor shall take instructions only from the Engineer (or his delegate).

14.1 **Programme to be Submitted**

The Contractor shall, within the time stated in Part II of these Conditions after the date of the Letter of Acceptance, submit to the Engineer for his consent a programme, in such form and detail as the Engineer shall reasonably prescribe, for the execution of the Works. The Contractor shall, whenever required by the Engineer, also provide in writing for his information a general description of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works. The Employer shall also be provided a copy of each document provided by the Contractor for record and information.

14.2 **Revised Programme**

If at any time it should appear to the Engineer that the actual progress of the Works does not conform to the programme to which consent has been given under Sub-Clause 14.1, the Contractor shall produce, at the request of the Engineer, a revised programme showing the modifications to such programme necessary to ensure completion of the Works within the Time for Completion. The Employer shall also be provided a copy of each document provided by the Contractor for record and information.

14.3 **Cash Flow Estimate to be Submitted**

The Contractor shall, within the time stated in Part II of these Conditions after the date of the Letter of Acceptance, provide to the Engineer for his information a detailed cash flow estimate, in quarterly periods, of all payments to which the Contractor will be entitled under the Contract and the Contractor shall subsequently supply revised cash flow estimates at quarterly intervals, if required to do so by the Engineer. The Employer shall also be provided a copy of each document provided by the Contractor for record and information.

14.4 **Contractor not Relieved of Duties or Responsibilities**

The submission to and consent by the Engineer of such programmes or the provision of such general descriptions or cash flow estimates shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

15.1 **Contractor's Superintendence**

The Contractor shall provide all necessary superintendence during the execution of the Works and as long thereafter as the Engineer may consider necessary for the proper fulfilling of the Contractor's obligations under the Contract. The Contractor, or a competent and authorised representative approved of by the Engineer, which approval may at any time be withdrawn, shall give his whole time to the superintendence of the Works. Such authorised representative shall receive, on behalf of the Contractor, instructions from the Engineer.

If approval of the representative is withdrawn by the Engineer, the Contractor shall, as soon as is practicable, having regard to the requirement of replacing him as hereinafter mentioned, after receiving notice of such withdrawal, remove the representative from the Works and shall not thereafter employ him again on the Works in any capacity and shall replace him by another representative approved by the Engineer.

16.1 **Contractor's Employees**

The Contractor shall provide on the Site in connection with the execution and completion of the Works and the remedying of any defects therein:

(a) only such technical assistants as are skilled and experienced in their respective callings and such foremen and leading hands as are competent to give proper superintendence of the Works, and

(b) such skilled, semi skilled and unskilled labour as is necessary for the proper and timely fulfilling of the Contractor's obligations under the Contract.

16.2 **Engineer at Liberty to Object**

The Engineer shall be at liberty to object to and require the Contractor to remove forthwith from the Works any person provided by the Contractor who, in the opinion of the Engineer, misconducts himself, or is incompetent or negligent in the proper performance of his duties, or whose presence on Site is otherwise considered by the

Engineer to be undesirable, and such person shall not be again allowed upon the Works without the consent of the Engineer. Any person so removed from the Works shall be replaced as soon as possible. The Employer may also register objection in this regard for reasonable decision by the Engineer.

17.1 **Setting-out**

The Contractor shall be responsible for:

(a) the accurate setting-out of the Works in relation to original points, lines and levels of reference given by the Engineer in writing,

(b) the correctness, subject as above mentioned of the position, levels dimensions and alignment of all parts of the Works, and

(c) the provision of all necessary instruments, appliances and labour in connection with the foregoing responsibilities.

If, at any time during the execution of the Works, any error appears in the position, levels, dimensions or alignment of any part of the Works, the Contractor, on being required so to do by the Engineer, shall, at his own cost, rectify such error to the satisfaction of the Engineer, unless such error is based on incorrect data supplied in writing by the Engineer, in which case the Engineer shall determine an addition to the Contract Price in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Employer.

The checking of any setting-out or of any line or level by the Engineer shall not in any way relieve the Contractor of his responsibility for the accuracy thereof and the Contractor shall carefully protect and preserve all bench-marks, sight-rails, pegs and other things used in setting-out the Works.

18.1 **Boreholes and Exploratory Excavation**

If, at any time during the execution of the Works, the Engineer requires the Contractor to make boreholes or to carry out exploratory excavation, such requirement shall be the subject of an instruction in accordance with Clause 51, unless an item or a Provisional Sum in respect of such work is included in the Bill of Quantities.

19.1 **Safety, Security and Protection of the Environment**

The Contractor shall, throughout the execution and completion of the Works and the remedying of any defects therein:

(a) have full regard for the safety of all persons entitled to be upon the Site and keep the Site (so far as the same is under his control) and the Works (so far as the same are not completed or occupied by the Employer) in an orderly state appropriate to the avoidance of danger to such persons,

(b) provide and maintain at his own cost all lights, guards, fencing, warning signs and watching, when and where necessary or required by the Engineer or by any

duly constituted authority, for the protection of the Works or for the safety and convenience of the public or others, and

(c) take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation.

19.2 **Employer's Responsibilities**

If under Clause 31 the Employer shall carry out work on the Site with his own workmen he shall, in respect of such work:

(a) have full regard to the safety of all persons entitled to be upon the Site, and

(b) keep the Site in an orderly state appropriate to the avoidance of danger to such persons.

If under Clause 31 the Employer shall employ other contractors on the Site he shall require them to have the same regard for safety and avoidance of danger.

20.1 **Care of Works**

The Contractor shall take full responsibility for the care of the Works and materials and Plant for incorporation therein from the Commencement Date until the date of issue of the Taking-Over Certificate for the whole of the Works, when the responsibility for the said care shall pass to the Employer. Provided that:

(a) if the Engineer issues a Taking-Over Certificate for any Section or part of the Permanent Works the Contractor shall cease to be liable for the care of that Section or part from the date of issue of the Taking-Over Certificate, when the responsibility for the care of that Section or part shall pass to the Employer, and

(b) the Contractor shall take full responsibility for the care of any outstanding Works and materials and Plant for incorporation therein which he undertakes to finish during the Defects Liability Period until such outstanding Works have been completed pursuant to Clause 49.

20.2 **Responsibility to Rectify Loss or Damage**

If any loss or damage happens to the Works, or any part thereof, or materials or Plant for incorporation therein, during the period for which the Contractor is responsible for the care thereof, from any cause whatsoever, other than the risks defined in Sub-Clause 20.4, the Contractor shall, at his own cost, rectify such loss or damage so that the Permanent Works conform in every respect with the provisions of the Contract to the satisfaction of the Engineer. The Contractor shall also be liable for any loss or damage to the Works occasioned by him in the course of any operations carried out by him for the purpose of complying with his obligations under Clauses 49 and 50.

20.3 **Loss or Damage Due to Employer's Risks**

In the event of any such loss or damage happening from any of the risks defined in Sub-Clause 20.4, or in combination with other risks, the Contractor shall, if and to the extent required by the Engineer, rectify the loss or damage and the Engineer shall determine an addition to the Contract Price in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Employer. In the case of a combination or risks causing loss or damage any such determination shall take into account the proportional responsibility of the Contractor and the Employer.

20.4 **Employer's Risks**

The Employer's risks are:

(a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,

(b) rebellion, revolution, insurrection, or military or usurped power, or civil war,

(c) ionising radiations, or contamination by radio-activity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosive, or other hazardous properties of any explosive nuclear assembly or nuclear component thereof,

(d) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds,

(e) riot, commotion or disorder, unless solely restricted to employees of the Contractor or of his Subcontractor and arising from the conduct of the Works,

(f) loss or damage due to the use or occupation by the Employer of any Section or part of the Permanent Works, except as may be provided for in the Contract,

(g) 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. [It shall be ensured that the Design Consultants remain available for Top Supervision and rectification of any subsequent faults/ issues till the successful completion of the project/ closing of the contract including defect liability period if any];

(h) any operation of the forces of nature against which an experienced contractor could not reasonably have been expected to take precautions.

21.1 **Insurance of Works and Contractor's Equipment**

The Contractor shall, without limiting his or the Employer's obligations and responsibilities under Clause 20, insure:

(a) the Works, together with materials and Plant for incorporation therein, to the full replacement cost (the term “cost” in this context shall include profit),

(b) an additional sum of 15 per cent of such replacement cost, or as may be specified in Part II of these Conditions, to cover any additional costs of and incidental to the rectification of loss or damage including professional fees and the cost of demolishing and removing any part of the Works and of removing debris of whatsoever nature, and

(c) the Contractor's Equipment and other things brought onto the Site by the Contractor, for a sum sufficient to provide for their replacement at the Site.

21.2 **Scope of Cover**

The insurance in paragraphs (a) and (b) of Sub-Clause 21.1 shall be in the joint names of the Contractor and the Employer and shall cover:

(a) the Employer and the Contractor against all loss or damage from whatsoever cause arising, other than as provided in Sub-Clause 21.4, form the start of work at the Site until the date of issue of the relevant Taking-Over Certificate in respect of the Works or any Section or part thereof as the case may be, and

(b) the Contractor for his liability:

(i) during the Defects Liability Period for loss or damage arising from a cause occurring prior to the commencement of the Defects Liability Periods, and

(ii) for loss or damage occasioned by the Contractor in the course of any operations carried out by him for the purpose of complying with his obligations under Clauses 49 and 50.

21.3 **Responsibility for Amounts not Recovered**

Any amounts not insured or not recovered from the insurers shall be borne by the Employer or the Contractor in accordance with their responsibilities under Clause 20.

21.4 **Exclusions**

There shall be no obligation for the insurances in Sub-Clause 21.1 to include loss or damage caused by:

(a) war, hostilities (where war be declared or not), invasion, act of foreign enemies,

(b) rebellion, revolution, insurrection, or military or usurped power, or civil war,

(c) ionising, radiations, or contamination by radio-activity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof, or

(d) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds.

22.1 **Damage to Persons and Property**

The Contractor shall, except if and so far as the Contract provides otherwise, indemnify the Employer against all losses and claims in respect of:

(a) death of or injury to any person, or

(b) loss of or damage to any property (other than the Works),

which may arise out of or in consequence of the execution and completion of the Works and the remedying of any defects therein, and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto, subject to the exceptions defined in Sub-Clause 22.2.

22.2 **Exceptions**

The "exceptions" referred to in Sub-Clause 22.1 are:

(a) the permanent use or occupation of land by the Works, or any part thereof,

(b) the right of the Employer to execute the Works, or any part thereof, on, over, under, is or through any land,

(c) damage to property which is the unavoidable result of the execution and completion of the Works, or the remedying of any defects therein, in accordance with the Contract, and

(d) death of or injury to persons or loss of or damage to property resulting from any act or neglect of the Employer, his agents servants or other contractors, not being employed by the Contractor, or in respect of any claims, proceedings, damages, costs, charges and expenses in respect thereof or in relation thereto or, where the injury or damage was contributed to by the Contractor, his servants or agents, such part of the said injury or damage as may be just and equitable having regard to the extent of the responsibility of the Employer, his servants or agents or other contractors for the injury or damage.

22.3 **Indemnity by Employer**

The Employer shall indemnify the Contractor against all claims, proceedings, damages, costs, charges and expenses in respect of the matters referred to in the exceptions defined in Sub-Clause 22.2

23.1 **Third Party Insurance (including Employer's Property)**

The Contractor shall, without limiting his or the Employer's obligation and responsibilities under Clause 22, insure, in the joint names of the Contractor and the Employer, against liabilities for death of or injury to any person (other than as provided in Clause 24) or loss of or damage to any property (other than the Works) arising out of the performance of the Contract, other than the exceptions defined in paragraphs (a), (b) and (c) of Sub-Clause 22.2.

23.2 **Minimum Amount of Insurance**

Such insurance shall be for at least the amount stated in the Appendix to Tender.

23.3 **Cross Liabilities**

The insurance policy shall include a cross liability clause such that the insurance shall apply to the Contractor and to the Employer as separate insureds.

24.1 **Accident or Injury to Workmen**

The Employer shall not be liable for or in respect of any damages or compensation payable to any workman or other person in the employment of the Contractor or any Subcontractor, other than death or injury resulting from any act or default of the Employer, his agents or servants. The Contractor shall indemnify and keep indemnified the Employer against all such damages and compensation, other than those for which the Employer is liable as aforesaid, and against all claims, proceedings, damages, costs, charges, and expenses whatsoever in respect thereof or in relation thereto.

24.2 **Insurance Against Accident to Workmen**

The Contractor shall insure against such liability and shall continue such insurance during the whole of the time that any persons are employed by him on the Works. Provided that, in respect of any persons employed by any Subcontractor, the Contractor's obligations to insure as aforesaid under the Sub-Clause shall be satisfied if the Subcontractor shall have insured against the liability in respect of such persons in such manner that the Employer is indemnified under the policy, but the Contractor shall require such Subcontractor to produce to the Employer, when required, such policy of insurance and the receipt for the payment of the current premium.

25.1 **Evidence and Terms of Insurances**

The Contractor shall provide evidence to the Employer prior to the start of work at the Site that the insurances required under the Contract have been effected and shall, within 84 days of the Commencement Date, provide the insurance policies to the Employer. When providing such evidence and such policies to the Employer, the Contractor shall notify the Engineer of so doing. Such insurance policies shall be consistent with the general terms agreed prior to the issue of the Letter of Acceptance. The Contractor shall effect all insurances for which he is responsible with insurers and in terms approved by the Employer.

25.2 **Adequacy of Insurances**

The Contractor shall notify the insurers of changes in the nature, extent or programme for the execution of the Works and ensure the adequacy of the insurances at all times in accordance with the terms of the Contract and shall, when required, produce to the Employer the insurance policies in force and the receipts for payment of the current premiums.

25.3 **Remedy on Contractor's Failure to Insure**

If the Contractor fails to effect and keep in force any of the insurances required under the Contract, or fails to provide the policies to the Employer within the period required by Sub-Clause 25.1, then and in any such case the Employer may effect and keep in force any such insurances and pay any premium as may be necessary for that purpose and from time to time deduct the amount so paid from any monies due or to become due to the Contractor, or recover the same as a debt due from the Contractor.

25.4 **Compliance with Policy Conditions**

In the event that the Contractor or the Employer fails to comply with conditions imposed by the insurance policies effected pursuant to the Contract, each shall indemnify the other against all losses and claims arising from such failure.

26.1 **Compliance with Statutes, Regulations**

The Contractor shall conform in all respects, including by the giving of all notices and the paying of all fees, with the provisions of:

(a) any National or State Statute, Ordinance, or other Law, or any regulation, or bye-law of any local or other duly constituted authority in relation to the execution and completion of the Works and the remedying of any defects therein, and

(b) the rules and regulations of all public bodies and companies whose property or rights are affected or may be affected in any way by the Works,

and the Contractor shall keep the Employer indemnified against all penalties and liability of every kind for breach of any such provisions. Provided always that the Employer shall be responsible for obtaining any planning, zoning or other similar permission required for the Works to proceed and shall indemnify the Contractor in accordance with Sub-Clause 22.3.

27.1 **Fossil**

All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the Site shall, as between the Employer and the Contractor, be deemed to be the absolute property of the Employer. The Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing or damaging any such article or thing and shall, immediately upon discovery thereof and before removal, acquaint the Engineer of such discovery and carry out the Engineer's instructions for dealing with the same. If, by reason of such instructions, the Contractor suffers delay and/or incurs costs then the Engineer shall, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44, and
(b) the amount of such costs, which shall be added to the Contract Price,
and shall notify the Contractor accordingly, with a copy to the Employer.

28.1 **Patent Rights**

The Contractor shall save harmless and indemnify the Employer from and against all claims and proceedings for or on account of infringement of any patent rights, design trademark or name or other protected rights in respect of any Contractor's Equipment, materials or Plant used for or in connection with or for incorporation in the Works and from and against all damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto, except where such infringement results from compliance with the design or Specification provided by the Engineer.

28.2 **Royalties**

Except where otherwise stated, the Contractor shall pay all tonnage and other royalties, rent and other payments or compensation, if any, for getting stone, sand, gravel, clay or other materials required for the Works.

29.1 **Interference with Traffic and Adjoining Properties**

All operations necessary for the execution and completion of the Works and the remedying of any defects therein shall, so far as compliance with the requirements of the Contract permits, be carried on so as not to interfere unnecessarily or improperly with:

(a) the convenience of the public, or

(b) the access to, use and occupation of public or private roads and footpaths to or of properties whether in the possession of the Employer or of any other person.

The Contractor shall save harmless and indemnify the Employer in respect of all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of, or in relation to, any such matters insofar as the Contractor is responsible therefore.

30.1 **Avoidance of Damage to Roads**

The Contractor shall use every reasonable means to prevent any of the roads or bridges communicating with or on the routes to the Site from being damaged or injured by any traffic of the Contractor or any of his Subcontractors and, in particular, shall select routes, choose and use vehicles and restrict and distribute loads so that any such extraordinary traffic as will inevitably arise from the moving of materials, Plant, Contractor's Equipment or Temporary Works from and to the Site shall be limited, as far as reasonably possible, and so that no unnecessary damage or injury may be occasioned to such roads and bridges.

30.2 **Transport of Contractor's Equipment or Temporary Works**

Save insofar as the Contract otherwise provides, the Contractor shall be responsible for and shall pay the cost of strengthening any bridges or altering or improving any road communicating with or on the routes to the Site to facilitate the movement of Contractor's Equipment or Temporary Works and the Contractor shall indemnify and keep indemnified the Employer against all claims for damage to any such road or bridge caused by such movement, including such claims as may be made directly against the Employer, and shall negotiate and pay all claims arising solely out of such damage.

30.3 **Transport of Materials or Plant**

If, notwithstanding Sub-Clause 30.1, any damage occurs to any bridge or road communicating with or on the routes to the Site arising from the transport of materials or Plant, the Contractor shall notify the Engineer with a copy to the Employer, as

soon as he becomes aware of such damage or as soon as he receives any claim from the authority entitled to make such claim. Where under any law or regulation the haulier of such materials or Plant is required to indemnify the road authority against damage the Employer shall not be liable for any costs, charges or expenses in respect thereof or in relation thereto. In other cases the Employer shall negotiate the settlement of and pay all sums due in respect of such claim and shall indemnify the Contractor in respect thereof and in respect of all claims, proceedings damages, costs, charges and expenses in relation thereto. Provided that if and so far as any such claim or part thereof is, in the opinion of the Engineer, due to any failure on the part of the Contractor to observe and perform his obligations under Sub-Clause 30.1, then the amount determined by the Engineer, after due consultation with the Employer and the Contractor, to be due to such failure shall be recoverable from the Contractor by the Employer and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer. Provided also that the Employer shall notify the Contractor whenever a settlement is to be negotiated and, where any amount may be due from the Contractor, the Employer shall consult with the Contractor before such settlement is agreed.

30.4 **Waterborne Traffic**

Where the nature of the Works is such as to require the use by the Contractor of waterborne transport the foregoing provisions of this Clause shall be construed as though "road" included a lock, dock, sea wall or other structure related to a waterway and "vehicle" included craft, and shall have effect accordingly.

31.1 **Opportunities for Other Contractors**

The Contractor shall, in accordance with the requirements of the Engineer, afford all reasonable opportunities for carrying out their work to:

(a) any other contractors employed by the Employer and their workmen,

(b) the workmen of the Employer, and

(c) the workmen of any duly constituted authorities who may be employed in the execution on or near the Site of any work not included in the Contract or of any contract which the Employer may enter into in connection with or ancillary to the Works.

31.2 **Facilities for Other Contractors**

If, however, pursuant to Sub-Clause 31.1 the Contractor shall, on the written request of the Engineer:

(a) make available to any other contractor, or to the Employer or any such authority, any roads or ways for the maintenance of which the Contractor is responsible,

(b) permit the use, by any such, of Temporary Works or Contractor's Equipment on the Site, or

(c) provide any other service of whatsoever nature for any such,

the Engineer shall determine an addition to the Contract Price in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Employer.

32.1 **Contractor to Keep Site Clear**

During the execution of the Works the Contractor shall keep the Site reasonably free from all unnecessary obstruction and shall store or dispose of any Contractor's Equipment and surplus materials and clear away and remove from the Site any wreckage, rubbish or Temporary Works no longer required.

33.1 **Clearance of Site on Completion**

Upon the issue of any Taking-Over Certificate the Contractor shall clear away and remove from that part of the Site to which such Taking-Over Certificate relates all Contractor's Equipment, surplus materials, rubbish and Temporary Works of every kind, and leave such part of the Site and Works clean and in a workmanlike condition to the satisfaction of the Engineer. Provided that the Contractor shall be entitled to retain on Site, until the end of the Defects Liability Period, such materials, Contractor's Equipment and Temporary Works as are required by him for the purpose of fulfilling his obligations during the Defects Liability Period.

Labour

34.1 **Engagement of Staffs and Labour**

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

35.1 **Returns of Labour and Contractor's Equipment**

The Contractor shall, if required by the Engineer, deliver to the Engineer a return in detail, in such form and at such intervals as the Engineer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such information respecting Contractor's Equipment as the Engineer may require.

Materials, Plant and Workmanship

36.1 **Quality of Materials, Plant and Workmanship**

All materials, Plant and workmanship shall be:

(a) of the respective kinds described in the Contract and in accordance with the Engineer's instructions, and

(b) subjected from time to time to such tests as the Engineer may require at the place of manufacture, fabrication or preparation, or on the Site or at such other place or places as may be specified in the Contract, or at all or any of such places.

The Contractor shall provide such assistance, labour, electricity, fuels, stores, apparatus and instruments as are normally required for examining, measuring and testing any materials or Plant and shall supply samples of materials, before incorporation in the Works, for testing as may be selected and required by the Engineer.

36.2 **Cost of Samples**

All samples shall be supplied by the Contractor at his own cost if the supply thereof is clearly intended by or provided for in the Contract.

36.3 **Cost of Tests**

The cost of making any test shall be borne by the Contractor if such test is:

(a) clearly intended by or provided for in the Contract, or

(b) particularised in the Contract (in cases only for a test under load or of a test to ascertain whether the design of any finished or partially finished work is appropriate for the purposes which it was intended to fulfil) in sufficient detail to enable the Contractor to price or allow for the same in his Tender.

36.4 **Cost of Tests not Provided for**

If any test required by the Engineer which is:

(a) not intended by or provided for,

(b) (in the cases above mentioned) not so particularised, or

(c) (through so intended or provided for) required by the Engineer to be carried out at any place other than the Site or the place of manufacture, fabrication or preparation of the materials or Plant tested,

shows the materials, Plant or workmanship not to be in accordance with the provisions of the Contract to the satisfaction of the Engineer, then the cost of such test shall be borne by the Contractor, but in any other case Sub-Clause 36.5 shall apply.

36.5 **Engineer's Determination where Tests not Provided for**

Where, pursuant to Sub-Clause 36.4, this Sub-Clause applies the Engineer shall, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time of which the Contractor is entitled under Clause 44, and

(b) the amount of such costs, which shall be added to the Contract Price,

and shall notify the Contractor accordingly, with a copy to the Employer.

37.1 Inspection of Operations

The Engineer, and any person authorised by him, shall at all reasonable times have access to the Site and to all workshops and places where materials or Plant are being manufactured, fabricated or prepared for the Works and the Contractor shall afford every facility for and every assistance in obtaining the right to such access. The Employer may also inspect the site/ works anytime and may record and duly communicate the observations, specially w.r.t. quality and quantity, for reasonable and just decision by the Engineer for which the Engineer shall be personally held responsible along-with the Resident Supervision firm if any which employed the Engineer.

37.2 Inspection and Testing

The Engineer shall be entitled, during manufacture, fabrication or preparation to inspect and test the materials and Plant to be supplied under the Contract. If materials or Plant are being manufactured, fabricated or prepared in workshops or places other than those of the Contractor, the Contractor shall obtain permission for the Engineer to carry out such inspection and testing in those workshops or places. Such inspection or testing shall not release the Contractor from any obligation under the Contract. The Employer may also inspect the site/ works anytime and may record and duly communicate the observations, specially w.r.t. quality and quantity, for reasonable and just decision by the Engineer for which the Engineer shall be personally held responsible along-with the Resident Supervision firm if any which employed the Engineer.

37.3 Dates for Inspection and Testing

The Contractor shall agree with the Engineer on the time and place for the inspection or testing of any materials or Plant as provided in the Contract. The Engineer shall give the Contractor not less than 24 hours notice of his intention to carry out the inspection or to attend the tests. If the Engineer, or his duly authorised representative, does not attend on the date agreed, the Contractor may, unless otherwise instructed by the Engineer, proceed with the tests, which shall be deemed to have been made in the presence of the Engineer. The Contractor shall forthwith forward to the Engineer duly certified copies of the tests readings. If the Engineer has not attended the tests, he shall accept the said readings as accurate.

37.4 Rejection

If, at the time and place agreed in accordance with Sub-Clause 37.3, the materials or Plant are not ready for inspection or testing or if, as a result of the inspection or testing referred to in this Clause, the Engineer determines that the materials or Plant are defective or otherwise not in accordance with the Contract, he may reject the materials or Plant and shall notify the Contractor thereof immediately. The notice shall state the Engineer's objections with reasons. The Contractor shall then promptly make good the defect or ensure that rejected materials or Plant comply with the Contract. If the Engineer so requests, the tests of rejected materials or Plant shall be made or repeated under the same terms and conditions. All costs incurred by the Employer by the repetition of the test shall after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the

Contractor by the Employer and may be deducted from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

37.5 **Independent Inspection**

The Engineer may delegate inspection and testing of materials or Plant to an independent inspector. Any such delegation shall be effected in accordance with Sub-Clause 2.4 and for this purpose such independent inspector shall be considered as an assistant of the Engineer. Notice of such appointment (not being less than 14 days) shall be given by the Engineer to the Contractor.

38.1 **Examination of Work before Covering up**

No part of the works shall be covered up or put out of view without the approval of the Engineer and the Contractor shall afford full opportunity for the Engineer to examine and measure any such part of the Works which is about to be covered up or put out of view and to examine foundations before any part of the Works is placed thereon. The Contractor shall give notice to the Engineer whenever any such part of the Works or foundations is or are ready or about to be ready for examination and the Engineer shall, without unreasonable delay, unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such part of the Works or of examining such foundations. A copy of such notices shall also be communicated to the Employer.

38.2 **Uncovering and Making Openings**

The Contractor shall uncover any part of the Works or make openings in or through the same as the Engineer may from time to time instruct and shall reinstate and make good such part. If any such part has been covered up or put out of view after compliance with the requirement of Sub-Clause 38.1 and is found to be executed in accordance with the Contract, the Engineer shall, after due consultation with the Employer and the Contractor, determine the amount the Contractor's costs in respect of such of uncovering, making openings in or through, reinstating and making good the same, which shall be added to the Contract Price, and shall notify the Contractor accordingly, with a copy to the Employer. In any other case all costs shall be borne by the Contractor.

39.1 **Removal of Improper Work, Materials or Plant**

The Engineer shall have authority to issue instructions from time to time, for:

(a) the removal from the Site, within such time or times as may be specified in the instruction, of any materials or Plant which, in the opinion of the Engineer, are not in accordance with the Contract,

(b) the substitution of proper and suitable materials or Plant, and

(c) the removal and proper re-execution, notwithstanding any previous test thereof or interim payment therefore, of any work which, in respect of

(i) materials, Plant or workmanship, or

(ii) design by the Contractor or for which he is responsible,

is not, in the opinion of the Engineer, in accordance with the Contract.

39.2 **Default of Contractor in Compliance**

In case of default on the part of Contractor in carrying out such instruction within the time specified therein or, if none, within a reasonable time, the Employer shall be entitled to employ and pay other persons to carry out the same and all costs consequent thereon or incidental thereto shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

Suspension

40.1 **Suspension of Work**

The Contractor shall, on the instructions of the Engineer, suspend the progress of the Works or any part thereof for such time and in such manner as the Engineer may consider necessary and shall, during such suspension, properly protect and secure the Works or such part thereof so far as is necessary in the opinion of the Engineer. Unless such suspension is:

(a) otherwise provided for in the Contract,

(b) necessary by reason of some default of or breach of contract by the Contractor or for which he is responsible,

(c) necessary by reason of climatic conditions of the Site, or

(d) necessary for the proper execution of the Works or for the safety of the Works or any part thereof (save to the extent that such necessity arises from any act or default by the Engineer or the Employer or from any of the risks defined in Sub-Clause 20.4), Sub-Clause 40.2 shall apply.

40.2 **Engineer's Determination following Suspension**

Where, if specifically mentioned in the SCC, pursuant to Sub-Clause 40.1, this Sub-Clause applies the Engineer shall, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44, and

(b) the amount, which shall be added to the Contract Price, in respect of the cost incurred by the Contractor by reason of such suspension,

and shall notify the Contractor accordingly, with a copy to the Employer *{inclusion of this clause is to be decided by the procuring agency}*.

40.3 **Suspension lasting more than 84 Days**

If the progress of the Works or any part thereof is suspended on the written instructions of the Engineer and if permission to resume work is not given by the Engineer within a period for 84 days from the date of suspension then, unless such suspension is within paragraph (a), (b), (c) or (d) of Sub-Clause 40.1, the Contractor may give notice to the Engineer requiring permission, within 30 days from the receipt thereof, to proceed with the Works or that part thereof in regard to which progress is suspended. If, within the said time, such permission is not granted, the Contractor may, but is not bound to, elect to treat the suspension, where it affects part only of the Works, as an omission of such part under Clause 51 by giving a further notice to the Engineer to that effect, or, where it affects the whole of the Works, treat the suspension as an event of default by the Employer and terminates his employment under the Contract in accordance with the provisions of Sub-Clause 69.1, whereupon the provisions of Sub-Clause 69.2 and 69.3 shall apply. The above course may be adopted if specifically given in the SCC.

Commencement and Delays

41.1 **Commencement of Works**

The Contractor shall commence the Works as soon as is reasonably possible after the receipt by him of notice to this effect from the Engineer, which notice shall be issued within the time stated in the Appendix to Tender after the date of the Letter of Acceptance. Thereafter, the Contractor shall proceeded with the Works with due expedition and without delay.

42.1 **Possession of Site and Access Thereto**

Save insofar as the Contract may prescribe:

(a) the extent of portions of the Site of which the Contractor is to be given possession from time to time,

(b) the order in which such portions shall be made available to the Contractor,

and, subject to any requirement in the Contract as to the order in which the Works shall be executed, the Employer will, with the Engineer's notice to commence the Works, give to the Contractor possession of

(c) so much of the Site, and

(d) such access as, in accordance with the Contract, is to be provided by the Employer as may be required to enable the Contractor to commence and proceed with the execution of the Works in accordance with the programme referred to in Clause 14, if any, and otherwise in accordance with such reasonable proposals as the Contractor shall, by notice to the Engineer with a copy to the Employer, make. The

Employer will, from time to time as the Works proceed, give to the Contractor possession of such further portions of the Site as may be required to enable the Contractor to proceed with the execution of the Works with due dispatch in accordance with such programme or proposals, as the case may be.

42.2 **Failure to Give Possession**

If the Contractor suffers delay and/or incurs costs from failure on the part of the Employer to give possession in accordance with the terms of Sub-Clause 42.1, the Engineer may, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44, and

(b) the amount of such costs, which shall be added to the Contract Price,

and shall notify the Contractor accordingly, with a copy to the Employer.

42.3 **Rights of Way and Facilities**

The Contractor shall bear all costs and charges for special or temporary wayleaves required by him in connection with access to the Site. The Contractor shall also provide at his own cost any additional facilities outside the Site required by him for the purposes of the Works.

43.1 **Time for Completion**

The whole of the Works and, if applicable, any Section required to be completed within a particular time as stated in the Appendix to Tender, shall be completed, in accordance with the provisions of Clause 48, within the time stated in the Appendix to Tender for the whole of the Works or the Section (as the case may be), calculated from the Commencement Date, or such extended time as may be allowed under Clause 44.

44.1 **Extension of Time for Completion**

In the event of:

(a) the amount or nature of extra or additional work,

(b) any cause of delay referred to in these Conditions,

(c) exceptionally adverse climatic conditions,

(d) any delay, impediment or prevention by the Employer, or

(e) other special circumstances which may occur, other than through a default of or breach of contract by the Contractor or for which he is responsible,

Being such as fairly to entitle the Contractor to an extension of the Time for Completion of the Works, or any Section or part thereof, the Engineer shall, after due

consultation with the Employer and the Contractor, determine the amount of such extension and shall notify the Contractor accordingly, with a copy to the Employer.

44.2 **Contractor to Provide Notification and Detailed Particulars**

Provided that the Engineer is not bound to make any determination unless the Contractor has

(a) within 30 days after such event has first arisen notified the Engineer with a copy to the Employer, and

(b) within 30 days or such other reasonable time as may be agreed by the Engineer, after such notification submitted to the Engineer detailed particulars of any extension of time to which he may consider himself entitled in order that such submission may be investigated at the time.

44.3 **Interim Determination of Extension**

Provided also that where an event has a continuing effect such that it is not practicable for the Contractor to submit detailed particulars within the period of 30 days referred to in Sub-Clause 44.2(b), he shall nevertheless be entitled to an extension of time provided that he has submitted to the Engineer interim particulars at intervals of not more than 30 days and final particulars within 30 days of the end of the effects resulting from the event. On receipt of such interim particulars, the Engineer shall, without undue delay, make an interim determination of extension of time and, on receipt of the final particulars, the Engineer shall review all the circumstances and shall determine an overall extension of time in regard to the event. In both such cases the Engineer shall make his determination after due consultation with the Employer and the Contractor and shall notify the Contractor of the determination, with a copy to the Employer. No final review shall result in a decrease of any extension of time already determined by the Engineer.

45.1 **Restriction on Working Hours**

Subject to any provision to the contrary contained in the Contract, none of the Works shall, save as hereinafter provided, be carried on during the night or on locally recognised days of rest without the consent of the Engineer, except when work is unavoidable or absolutely necessary for the saving of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer. Provided that the provisions of this Clause shall not be applicable in the case of any work which it is customary to carry out by multiple shifts.

46.1 **Rate of Progress**

If for any reason, which does not entitle the Contractor to an extension of time, the rate of progress of the Works or any Section is at any time, in the opinion of the Engineer, too slow to comply with the Time for Completion, the Engineer shall so notify the Contractor who shall thereupon take such steps as are necessary, subject to the consent of the Engineer, to expedite progress so as to comply with the Time for Completion. The Contractor shall not be entitled to any additional payment for taking such steps. If, as a result of any notice given by the Engineer under this Clause, the

Contractor considers that it is necessary to do any work at night or on locally recognised days of rest, he shall be entitled to seek the consent of the Engineer so to do. Provided that if any steps, taken by the Contractor in meeting his obligations under this Clause, involve the Employer in additional supervision costs, such cost shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

47.1 **Liquidated Damages for Delay**

If the Contractor fails to comply with the Time for Completion in accordance with Clause 48, for the whole of the Works or, if applicable, any Section within the relevant time prescribed by Clause 43, then the Contractor shall pay to the Employer the relevant sum stated in the Appendix to Tender as liquidated damages for such default and not as a penalty (which sum shall be the only monies due from the Contractor for such default) for every day or part of a day which shall elapse between the relevant Time for Completion and the date stated in a Taking-Over Certificate of the whole of the Works or the relevant Section, subject to the applicable limit stated in the Appendix to Tender. The Employer may, without prejudice to any other method of recovery, deduct the amount of such damages from any monies due or to become due to the Contractor. The payment or deduction of such damages shall not relieve the Contractor from his obligation to complete the Works, or from any other of his obligations and liabilities under the Contract.

47.2 **Reduction of Liquidated Damages**

If, before the Time for Completion of the whole of the Works or, if applicable, any Section, a Taking-Over Certificate has been issued for any part of the Works or of a Section, the liquidated damages for delay in completion of the remainder of the Works or of that Section shall, for any period of delay after the date stated in such Taking-Over Certificate, and in the absence of Alternative provisions in the Contract, be reduced in the proportion which the value of the part so certified bears to the value of the whole of the Works or Section, as applicable. The provisions of this Sub-Clause shall only apply to the rate of liquidated damages and shall not affect the limit thereof.

48.1 **Taking-Over Certificate**

When the whole of the Works have been substantially completed and have satisfactorily passed any Tests on Completion prescribed by the Contract, the Contractor may give a notice to that effect to the Engineer with a copy to the Employer, accompanied by a written undertaking to finish with due expedition any outstanding work during the Defects Liability Period. Such notice and undertaking shall be deemed to be a request by the Contractor for the Engineer to issue a Taking-Over Certificate in respect of the Works. The Engineer shall within 21 days of the date of delivery of such notice, either issue to the Contractor, with a copy to the Employer, a Taking-Over Certificate, stating the date on which, in his opinion, the Works were substantially completed in accordance with the Contract, or give instructions in writing to the Contractor specifying all the work which, in the

Engineer's opinion, is required to be done by the Contractor before the issue of such Certificate. The Engineer shall also notify the Contractor of any defects in the Works affecting substantial completion that may appear after such instructions and before completion of the Woks specified therein. The Contractor shall be entitled to receive such Taking-Over Certificate within 21 days of completion, to the satisfaction of the Engineer, of the Works so specified and remedying any defects so notified.

48.2 **Taking Over of Sections or Parts**

Similarly, in accordance with the procedure set out in Sub-Clause 48.1, the Contractor may request and the Engineer shall issue a Taking-Over Certificate in respect of:

(a) any Section in respect of which a separate Time for Completion is provided in the Appendix to Tender,

(b) any substantial part of the Permanent Works which has been both completed to the satisfaction of the Engineer and, otherwise than as provided for in the Contract, occupied or used by the Employer, or

(c) any part of the Permanent Works which the Employer has elected to occupy or use prior to completion (where such prior occupation or use is not provided for in the Contract or has not been agreed by the Contractor as a temporary measure).

48.3 **Substantial Completion of Parts**

If any part of the Permanent Works has been substantially completed and has satisfactorily passed any Tests on Completion prescribed by the Contractor, the Engineer may issue a Taking-Over Certificate in respect of that part of the Permanent Works before completion of the whole of the Works and, upon the issue of such Certificate, the Contractor shall be deemed to have undertaken to complete with due expedition any outstanding work in that part of the Permanent Works during the Defects Liability Period.

48.4 **Surfaces Requiring Reinstatement**

Provided that a Taking-Over Certificate given in respect of any Section or part of the Permanent Works before completion of the whole of the Works shall not be deemed to certify completion of any ground or surfaces requiring reinstatement, unless such Taking-Over Certificate shall expressly so state.

Defects Liability

49.1 **Defects Liability Period**

In these Conditions the expression "Defects Liability Period" shall mean the defects liability period named in the Appendix to Tender, calculated from:

(a) the date of completion of the Works certified by the Engineer in accordance with Clause 48, or

(b) in the event of more than one certificate having issued by the Engineer under Clause 48, the respective dates so certified,

and in relation to the Defects Liability Period the expression "the Works" shall be construed accordingly.

49.2 **Completion of Outstanding Work and Remedying Defects**

To the intent that the Works shall, at or as soon as practicable after the expiration of the Defects Liability Period, be delivered to the Employer in the condition required by the Contract, fair wear and tear excepted, to the satisfaction of the Engineer, the Contractor shall:
(a) complete the work, if any, outstanding on the date stated in the Taking-Over Certificate as soon as practicable after such date, and
(b) execute all such work of amendment, reconstruction, and remedying defects, shrinkages or other faults as the Engineer may, during the Defects Liability Period or within 14 days after its expiration, as a result of an inspection made by or on behalf of the Engineer prior to its expiration, instruct the Contractor to execute.

49.3 **Cost of Remedying Defects**

All work referred to in Sub-Clause 49.2(b) shall be executed by the Contractor at his own cost if the necessity thereof is, in the opinion of the Engineer, due to:

(a) the use of materials, Plant or workmanship not in accordance with the Contract,
(b) where the Contractor is responsible for the design of part of the Permanent Works, any fault i n such design, or
(c) the neglect or failure on the part of the Contractor to comply with any obligation, expressed or implied, on the Contractor's part under the Contract.

If, in the opinion of the Engineer, such necessity is due to any other cause, he shall determine an addition to the Contract Price in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Employer.

49.4 **Contractor's Failure to Carry Out Instructions**

In case of default on the part of the Contractor in carrying out such instruction within a reasonable time, the Employer shall be entitled to employ and pay other persons to carry out the same and if such work is work which, in the opinion of the Engineer, the Contractor was liable to do at his own cost under the Contract, then all cost consequent thereon or incidental thereto shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

50.1 **Contractor to Search**

If any defect, shrinkage or other fault in the Works appears at any time prior to the end of the Defects Liability Period, the Engineer may instruct the Contractor, with a

copy to the Employer, to search under the directions of the Engineer for the cause thereof. Unless such defect, shrinkage or other fault is one for which the Contractor is liable under the Contract, the Engineer shall, after due consultation with the Employer and the Contractor, determine the amount in respect of the costs of such search incurred by the Contractor, which shall be added to the Contract Price and shall notify the Contractor accordingly, with a copy to the Employer. If such defect, shrinkage or other fault is one for which the Contractor is liable, the cost of the work carried out in searching as aforesaid shall be borne by the Contractor and he shall in such case remedy such defect, shrinkage or other fault at his own cost in accordance with the provisions of Clause 49.

Alterations, Additions and Omissions

51.1 **Variations**

The Engineer shall make any variation of the form, quality or quantity of the Works or any part thereof that may, in his opinion, be necessary and for that purpose, or if for any other reason it shall, in his opinion, be appropriate, he shall have the authority to instruct the Contractor to do and the Contractor shall do any of the following:

(a) increase or decrease the quantity of any work included in the Contract,
(b) omit any such work (but not if the omitted work is to be carried out by the Employer or by another contractor),
(c) change the character or quality or kind of any such work,
(d) change the levels, lines, position and dimensions of any part of the Works,
(e) execute additional work of any kind necessary for the completion of the Works, or
(f) change any specified sequence or timing of construction of any part of the Works.

No such variation shall in any way vitiate or invalidate the Contract, but the effect, if any, of all such variations shall be valued in accordance with Clause 52. Provided that where the issue of an instruction to vary the Works is necessitated by some default of or breach of contract by the Contractor or for which he is responsible, any additional cost attributable to such default shall be borne by the Contractor.

51.2 **Instructions for Variations**

The Contractor shall not make any such variation without an instruction of the Engineer. Provided that no instruction shall be required for increase or decrease in the quantity of any work where such increase or decrease is not the result of an instruction given under this Clause, but is the result of the quantities exceeding or being less than those stated in the Bill of Quantities.

52.1 **Valuation of Variations**

All variations referred to in Clause 51 and any additions to the Contract Price which are required to be determined in accordance with Clause 52 (for the purposes of this Clause referred to as "varied work"), shall be valued at the rates and prices set out in the Contract if, in the opinion of the Engineer, the same shall be applicable. If the Contract does not contain any rates or prices applicable to the varied work, the rates

and prices in the Contract shall be used as the basis for valuation so far as may be reasonable, failing which, after due consultation by the Engineer with the Employer and the Contractor, suitable rates or prices shall be agreed upon between the Engineer and the Contractor. In the event of disagreement the Engineer shall fix such rates or prices as are, in his opinion, appropriate and shall notify the Contractor accordingly, with a copy to the Employer. Until such time as rates or prices are agreed or fixed, the Engineer shall determine provisional rates or prices to enable on-account payments to be included in certificates issued in accordance with Clause 60.

52.2 **Power of Engineer to Fix Rates**

Provided that if the nature or amount of any varied work relative to the nature or amount of the whole of the Works or to any part thereof, is such that, in the opinion of the Engineer, the rate or price contained in the Contract for any item of the Works is, by reason of such varied work, rendered inappropriate or inapplicable, then, after due consultation by the Engineer with the Employer and the Contractor, a suitable rate or price shall be agreed upon between the Engineer and the Contractor. In the event of disagreement the Engineer shall fix such other rate or price as is, in his opinion, appropriate and shall notify the Contractor accordingly, with a copy to the Employer. Until such time as rates or prices are agreed or fixed, the Engineer shall determine provisional rates or prices to enable on-account payments to be included in certificates issued in accordance with Clause 60.

Provided also that no varied work instructed to be done by the Engineer pursuant to Clause 51 shall be valued under Sub-Clause 52.1 or under this Sub-Clause unless, within 14 days of the date of such instruction and, other than in the case of omitted work, before the commencement of the varied work, notice shall have been given either:

(a) by the Contractor to the Engineer of his intention to claim extra payment or a varied rate or price, or
(b) by the Engineer to the Contractor of his intention to vary a rate or price.

52.3 **Variations Exceeding 15 per cent**

If, on the issue of the Taking-Over Certificate for the whole of the Works, it is found that as a result of:

(a) all varied work valued under Sub-Clauses 52.1 and 52.2, and
(b) all adjustments upon measurement of the estimated quantities set out in the Bill of Quantities, excluding Provisional Sums, dayworks and adjustment of price made under Clause 70.

but not from any other cause, there have been additions to or deductions from the Contract Price which taken together are in excess of 15 per cent of the "Effective Contract Price" (which for the purposes of this Sub-Clause shall mean the Contract Price, excluding Provisional Sums and allowance for dayworks, if any) then and in such event (subject to any action already taken under any other Sub-Clause of this Clause), after due consultation by the Engineer with the Employer and the Contractor, there shall be added to or deducted from the Contract Price such further sums as may be agreed between the Contractor and the Engineer or, failing agreement, determined

by the Engineer having regard to the Contractor's Site and general overhead costs of the Contract. The Engineer shall notify the Contractor of any determination made under this Sub-Clause, with a copy to the Employer. Such sum shall be based only on the amount by which such additions or deductions shall be in excess of 15 per cent of the Effective Contract Price.

52.4 **Daywork**

The Engineer may, if in his opinion it is necessary or desirable, issue an instruction that any varied work shall be executed on a daywork basis. The Contractor shall then be paid for such varied work under the terms set out in the daywork schedule included in the Contract and at the rates and prices affixed thereto by him in the Tender.

The Contractor shall furnish to the Engineer such receipts or other vouchers as may be necessary to provide the amounts paid and, before ordering material, shall submit to the Engineer quotations for the same for his approval.

In respect of such of the Works executed on a daywork basis , the Contractor shall during the continuance of such work, deliver each day to the Engineer an exact list in duplicate of the names, occupation and time of all workmen employed on such work and a statement, also in duplicate, showing the description and quantity of all materials and Contractor's Equipment used thereon or therefore other than Contractor's Equipment which is included in the percentage addition in accordance with such daywork schedule. One copy of each list and statement will, if correct, or when agreed, be signed by the Engineer and returned to the Contractor.

At the end of each month the Contractor shall deliver to the Engineer a priced statement of the labour, materials and Contractor's Equipment, except as aforesaid, used and the Contractor shall not be entitled to any payment unless such lists and statements have been fully and punctually rendered. Provided always that if the Engineer considers that for any reason the sending of such lists or statements by the Contractor, in accordance with the foregoing provision, was impracticable he shall nevertheless be entitled to authorise payment for such work, either as daywork, on being satisfied as to the time employed and the labour, materials and Contractor's Equipment used on such work, or at such value therefore as shall, in his opinion, be fair and reasonable.

Procedure for Claims

53.1 **Notice of Claims**

Notwithstanding any other provision of the Contract, if the Contractor intends to claim any additional payment pursuant to any Clause of these Conditions or otherwise, he shall give notice of his intention to the Engineer with a copy to the Employer, within 30 days after the event giving rise to the claim has first arisen; provided this is expressly provided in the SCC.

53.2 **Contemporary Records**

Upon the happening of the event referred to in Sub-Clause 53.1, the Contractor shall keep such contemporary records as may reasonably be necessary to support any claim

he may subsequently wish to make. Without necessarily admitting the Employer's liability, the Engineer shall, on receipt of a notice under Sub-Clause 53.1, inspect such contemporary records and may instruct the Contractor to keep any further contemporary records as are reasonable and may be material to the claim of which notice has been given. The Contractor shall permit the Engineer, the Employer and the Administrative Department, to inspect all records kept pursuant to this Sub-Clause and shall supply him with copies thereof as and when the Engineer so instructs.

53.3 **Substantiation of Claims**

Within 30 days, or such other reasonable time as may be agreed by the Engineer, of giving notice under Sub-Clause 53.1, the Contractor shall send to the Engineer an account giving detailed particulars of the amount claimed and the grounds upon which the claim is based; provided this is expressly provided in the SCC. Where the event giving rise to the claim has a continuing effect, such account shall be considered to be an interim account and the Contractor shall, at such intervals as the Engineer may reasonably require, send further interim accounts giving the accumulated amount of the claim and any further grounds upon which it is based. In cases where interim accounts are sent to the Engineer, the Contractor shall send a final account within 30 days of the end of the effects resulting from the event. The Contractor shall send a copy to the Employer and the Administrative Department all accounts sent to the Engineer pursuant to this Sub-Clause.

53.4 **Failure to Comply**

If the Contractor fails to comply with any of the provisions of this Clause in respect of any claim which he seeks to make, his entitlement to payment in respect thereof shall not exceed such amount as the Engineer or any arbitrator or arbitrators appointed pursuant to Sub-Clause 67.3 assessing the claim considers to be verified by contemporary records (whether or not such records were brought to the Engineer's notice as required under Sub-Clause 53.2 and 53.3).

53.5 **Payment of Claims**

The Contractor shall be entitled to have included in any interim payment certified by the Engineer pursuant to Clause 60 such amount in respect of any claim as the Engineer, after due consultation with the Employer and the Contractor, may consider due to the Contractor provided that the Contractor has supplied sufficient particulars to enable the Engineer to determine the amount due. If such particulars are insufficient to substantiate the whole of the claim, the Contractor shall be entitled to payment in respect of such part of the claim as such particulars may substantiate to the satisfaction of the Engineer. The Engineer shall notify the Contractor of any determination made under this Sub-Clause, with a copy to the Employer.

Contractor's Equipment, Temporary Works and Materials

54.1 **Contractor's Equipment, Temporary Works and Materials; Exclusive Use for the Works**

All Contractor's Equipment, Temporary Works and materials provided by the Contractor shall, when brought on to the Site, be deemed to be exclusively intended for the execution of the Works and the Contractor shall not remove the same or any part thereof, except for the purpose of moving it from one part of the Site to another, without the consent of the Engineer. Provided that consent shall not be required for vehicles engaged in transporting any staff, labour, Contractor's Equipment, Temporary Works, Plant or materials to or from the Site.

54.2 **Employer not Liable for Damage**

The Employer shall not at any time be liable, save as mentioned in Clauses 20 and 65, for the loss of or damage to any of the said Contractor's Equipment, Temporary Works or materials.

54.3 **Customs Clearance**

The Employer will use his best endeavours in assisting the Contractor, where required, in obtaining clearance through the Customs of Contractor's Equipment, materials and other things required for the Works.

54.4 **Re-export of Contractor's Equipment**

In respect of any Contractor's Equipment which the Contractor has imported for the purposes of the Works, the Employer will use his best endeavours to assist the Contractor, where required, in procuring any necessary Government consent to the re-export of such Contractor's Equipment by the Contractor upon the removal thereof pursuant to the terms of Contract.

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

With a view to securing, in the event of termination under Clause 63, the continued availability, for the purpose of executing the Works, of any hired Contractor's Equipment, the Contractor shall not bring on to the Site any hired Contractor's Equipment unless there is an agreement for hire thereof (which agreement shall be deemed not to include an agreement for hire purchase) which contains a provision that the owner thereof will, on request in writing made by the Employer within 7 days after the date on which any termination has become effective, and on the Employer undertaking to pay all hire charges in respect thereof from such date, hire such Contractor's Equipment to the Employer on the same terms in all respect as the same was hired to the Contractor save that the Employer shall be entitled to permit the use thereof by any other contractor employed by him for the purpose of execution and completing the Works and remedying any defects therein, under the terms of the said Clause 63.

54.6 **Costs for the Purpose of Clause 63**

In the event of the Employer entering into any agreement for the hire of Contractor's Equipment pursuant to Sub-Clause 54.5, all sums properly paid by the Employer under the provision of any such agreement and all costs incurred by him (including stamp duties) in entering into such agreement shall be deemed, for the purpose of

Clause 63, to be part of the cost of executing and completing the Works and the remedying of any defects therein.

54.7 **Incorporation of Clause in Subcontracts**

The Contractor shall, where entering into any subcontract for the execution of any part of the Works, incorporate in such subcontract (by reference or otherwise) the provisions of this Clause in relation to Contractor's Equipment, Temporary Works or materials brought on to the Site by the Subcontractor.

54.8 **Approval of Materials not Implied**

The operation of this Clause shall not be deemed to imply any approval by the Engineer of the materials or other matters referred to therein nor shall it prevent the rejection of any such materials at any time by the Engineer.

Measurement

55.1 **Quantities**

The quantities set out in the Bill of Quantities are the estimated quantities for the Works, and they are not to be taken as the actual and correct quantities of the Works to be executed by the Contractor in fulfillment of his obligations under the Contract.

56.1 **Works to be Measured**

The Engineer shall, except as otherwise stated, ascertain and determine by measurement the value of the Works in accordance with the Contract and the Contractor shall be paid that value in accordance with Clause 60. The Engineer shall, when he requires any part of the Works to be measured, give reasonable notice to the Contractor's authorised agent, who shall:

(a) forthwith attend or send a qualified representative to assist the Engineer in making such measurement, and

(b) supply all particulars required by the Engineer.

Should the Contractor not attend, or neglect or omit to send such representative, then the measurement made by the Engineer or approved by him shall be taken to be the correct measurement of such part of the Works. For the purpose of measuring such Permanent Works as are to be measured by records and drawings, the Engineer shall prepare records and drawings as the work proceeds and the Contractor, as and when called upon to do so in writing, shall, within 14 days, attend to examine and agree such records and drawings with the Engineer and shall sign the same when so agreed. If the Contractor does not attend to examine and agree such records and drawings, they shall be taken to be correct. If, after examination of such records and drawings, the Contractor does not agree the same or does not sign the same as agreed, they shall nevertheless be taken to be correct, unless the Contractor, within 14 days of such examination, lodges with the Engineer notice of the respects in which such records and drawings are claimed by him to be incorrect.

On receipt of such notice, the Engineer shall review the records and drawings and either confirm or vary them.

57.1 **Method of Measurement**

The Works shall be measured net, notwithstanding any general or local custom, except where otherwise provided for in the Contract.

57.2 **Breakdown of Lump Sum Items**

For the purposes of statements submitted in accordance with Sub-Clause 60.1, the Contractor shall submit to the Engineer, within 30 days after the receipt of the Letter of Acceptance, a breakdown for each of the lump sum items contained in the Tender. Such breakdowns shall be subject to the approval of the Engineer.

Provisional Sums

58.1 **Definition of "Provisional Sum"**

"Provisional Sum" means a sum included in the Contract and so designated in the Bill of Quantities for the execution of any part of the Works or for the supply of goods, materials, Plant or services, or for contingencies, which sum may be used, in whole or in part, or not at all, on the instructions of the Engineer. The Contractor shall be entitled to only such amounts in respect of the work, supply or contingencies to which such Provisional Sums relate as the Engineer shall determine in accordance with this Clause. The Engineer shall notify the Contractor of any determination made under this Sub-Clause, with a copy to the Employer.

58.2 **Use of Provisional Sums**

In respect of every Provisional Sum the Engineer shall have authority to issue instructions for the execution of work or for the supply of goods, material, Plant or services by:

(a) the Contractor, in which case the Contractor shall be entitled to an amount equal to the value thereof determined in accordance with Clause 52, and

(b) a nominated Subcontractor, as hereinafter defined, in which case the sum to be paid to the Contractor therefore shall be determined and paid in accordance with Sub-Clause 59.4.

58.3 **Production of Vouchers**

The Contractor shall produce to the Engineer all quotations, invoices, vouchers and accounts or receipts in connection with expenditure in respect of Provisional Sums, except where work is valued in accordance with rates or prices set out in the Tender.

Nominated Subcontractors

59.1 **Definition of "Nominated Subcontractors"**

All specialists, merchants, tradesmen and others executing any work or supplying any goods, materials, Plant or services for which Provisional Sums are included in

the Contract, who may have been or be nominated or selected or approved by the Employer or the Engineer, and all persons to whom by virtue of the provisions of the Contract the Contractor is required to subcontract shall, in the execution of such work or the supply of such goods, materials, Plant or services, be deemed to be subcontractors to the Contractor and are referred to in this Contract as "nominated Subcontractors".

59.2 **Nominated Subcontractors; Objection to Nomination**

The Contractor shall not be required by the Employer or the Engineer, or be deemed to be under any obligation, to employ any nominated Subcontractor against whom the Contractor may raise reasonable objection, or who declines to enter into subcontract with the Contractor containing provisions:

(a)that in respect of the work, goods, materials, Plant or services the subject of the subcontract, the nominated Subcontractor will undertake towards the Contractor such obligations and liabilities as will enable the Contractor to discharge his own obligations and liabilities towards the Employer under the terms of the Contract and will save harmless and indemnify the Contractor from and against the same and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of or in connection therewith, or arising out of or in connection with any failure to perform such obligations or to fulfill such liabilities, and

(b) that the nominated Subcontractor will save harmless and indemnity the Contractor from and against any negligence by the nominated Subcontractor, his agents, workmen and servants and from and against any misuse by him or them of any Temporary Works provided by the Contractor for the purposes of the Contract and from all claims as aforesaid.

59.3 **Design Requirements to be Expressly Stated**

If in connection with any Provisional Sum the services to be provided include any matter of design or specification of any part of the Permanent Works or of any Plant to be incorporated therein, such requirement shall be expressly stated in the Contract and shall be included in any nominated Subcontract. The nominated Subcontract shall specify that the nominated Subcontractor providing such services will save harmless and indemnify the Contractor from and against the same and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of or in connection with any failure to perform such obligations or to fulfill such liabilities.

59.4 **Payments to Nominated Subcontractors**

For all work executed or goods, materials, Plant or services supplied by any nominated Subcontractor, the Contractor shall be entitled to:

(a) the actual price paid or due to be paid by the Contractor, on the instructions of the Engineer, and in accordance with the subcontract;

(b) in respect of labour supplied by the Contractor, the sum, if any, entered in the Bill of Quantities or, if instructed by the Engineer pursuant to paragraph (a) of Sub-Clause 58.2, as may be determined in accordance with Clause 52; and

(c) in respect of all other charges and profit, a sum being a percentage rate of the actual price paid or due to be paid calculated, where provision has been made in the Bill of Quantities for a rate to be set against the relevant Provisional Sum, at the rate inserted by the Contractor against that item or, where no such provision has been made, at the rate inserted by the Contractor in the Appendix to Tender and repeated where provision for such is made in a special item provided in the Bill of Quantities for such purpose.

59.5 **Certification of Payments to Nominated Subcontractors**

Before issuing, under Clause 60 any certificate, which includes any payment in respect of work done or goods, materials, Plant or services supplied by any nominated Subcontractor, the Engineer shall be entitled to demand from the Contractor reasonable proof that all payments, less retentions, included in previous certificates in respect of the work or goods, materials, Plant or services of such nominated Subcontractor have been paid or discharged by the Contractor. If the Contractor fails to supply such proof then, unless the Contractor:

(a) satisfies the Engineer in writing that he has reasonable cause for withholding or refusing to make such payment, and

(b) produces to the Engineer reasonable proof that he has so informed such nominated Subcontractor in writing,

the Employer shall be entitled to pay to such nominated Subcontractor direct, upon the certificate of the Engineer, all payments, less retention, provided for in the nominated Subcontract, which the Contractor has failed to make to such nominated Subcontractor and to deduct by way of set-off the amount so paid by the Employer from any sums due or to become due from the Employer to the Contractor.

Provided that, where the Engineer has certified and the Employer has paid direct as aforesaid, the Engineer shall in issuing any further certificate in favour of the Contractor, deduct from the amount thereof the amount so paid, direct as aforesaid, but shall not withhold or delay the issue of the certificate itself when due to be issued under the terms of the Contract.

Certificates and Payment

60.1 **Monthly Statements**

The Contractor shall submit to the Engineer after the end of each month six copies for further process, and one copy each to the Employer and the Administrative Department, each signed by the Contractor's representative approved by the Engineer in accordance with the Sub-Clause 15.1, of a statement, in such form as the Engineer may from time to time prescribe, showing the amounts to which the Contractor considers himself to be entitled up to the end of the month in respect of:

(a) the value of the Permanent Works executed,

(b) any other items in the Bill of Quantities including those for Contractor's Equipment, Temporary Works, dayworks and the like,

(c) the percentage of the invoice value of listed materials, all as stated in the Appendix to Tender, and Plant delivered by the Contractor on the Site for incorporation in the Permanent Works but not incorporated in such Works,

(d) adjustments under Clause 70, and

(e) any other sum to which the Contractor may be entitled under the Contract or otherwise.

60.2 **Monthly Payments**

The Engineer shall, within 30 days of receiving such statement, certify to the Employer the amount of payment to the Contractor which he considers due and payable in respect thereof, subject:

(a) firstly, to the retention of the account calculated by applying the Percentage of Retention stated in the Appendix to Tender, to the amount to which the Contractor is entitled under paragraph (a), (b), (c) and (e) of Sub-Clause 60.1 until the amount so retained reaches the Limit of Retention Money stated in the Appendix to Tender, and

(b) Secondly, to the deduction, other than pursuant to Clause 47, of any sums which may have become due and payable by the Contractor to the Employer.

Provided that the Engineer shall not be bound to certify any payment under this Sub-Clause if the net amount thereof, after all retentions and deductions, would be less than the Minimum Amount of Interim Payment Certificates stated in the Appendix to Tender.

Notwithstanding the terms of this Clause or any other Clause of the Contract no amount will be certified by the Engineer for payment until the performance security, if required under the Contract, has been provided by the Contractor and approved by the Employer.

60.3 **Payment of Retention Money**

(a) Upon the issue of the Taking-Over Certificate with respect to the whole of the Works, one half of the Retention Money, or upon the issue of a Taking-Over Certificate with respect to a Section or part of the Permanent

Works only such proportion thereof as the Engineer determines having regard to the relative value of such Section or part of the Permanent Works, shall be certified by the Engineer for payment to the Contractor.

(b) Upon the expiration of the Defects Liability Period for the Works the other half of the Retention Money shall be certified by the Engineer for payment to the Contractor. Provided that, in the event of different Defects Liability Periods having

become applicable to different Sections or part of the Permanent Works pursuant to Clause 48, the expression "expiration of the Defects Liability Period" shall, for the purposes of this Sub-Clause, be deemed to mean the expiration of the latest of such periods. Provided also that if at such time, there shall remain to be executed by the Contractor any work instructed, pursuant to Clause 49 and 50, in respect of the Works, the Engineer shall be entitled to withhold certification until completion of such work of so much of the balance of the Retention Money as shall, in the opinion of the Engineer, represent the cost of the work remaining to be executed.

60.4 **Correction of Certificates**

The Engineer may by any Interim Payment Certificate make any correction or modification in any previous certificate which shall have been issued by him and shall have authority, if any work is not being carried out to his satisfaction, to omit or reduce the value of such work in any Interim Payment Certificate.

60.5 **Statement at Completion**

Not later than 84 days after the issue of the Taking-Over Certificate in respect of the whole of the Works, the Contractor shall submit to the Engineer a Statement at Completion with supporting documents showing in detail, in the form approved by the Engineer:

(a) the final value of all work done in accordance with the Contract up to the date stated in such Taking-Over Certificate,

(b) any further sums which the Contractor considers to be due, and

(c) an estimate of amounts which the Contractor considers will become due to him under the Contract.

The estimated amounts shall be shown separately in such Statement at Completion. The Engineer shall verify payment in accordance with Sub-Clause 60.2.

60.6 **Final Statement**

Not later than 56 days after the issue of the Defects Liability Certificate pursuant to Sub-Clause 62.1, the Contractor shall submit to the Engineer for consideration a draft final statement with supporting documents showing in detail, in the form approved by the Engineer:

(a) the value of all work done in accordance with the Contract, and
(b) any further sums which the Contractor considers to be due to him under the Contract.

If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer the final statement as agreed (for the purposes of these Conditions referred to as the "Final Statement").

If, following discussions between the Engineer and the Contractor and any changes to the draft final statement which may be agreed between them, it becomes evident that a dispute exists, the Engineer shall deliver to the Employer an Interim Payment Certificate for those parts of the draft final statement, if any, which are not in dispute. The dispute may then be settled in accordance with Clause 67.

60.7 **Discharge**

Upon submission of the Final Statement, the Contractor shall give to the Employer, with a copy to the Engineer, a written discharge confirming that the total of the Final Statement represents full and final settlement of all monies due to the Contractor arising out of or in respect of the Contract. Provided that such discharge shall become effective only after payment due under the Final Payment Certificate issued pursuant to Sub-Clause 60.8 has been made and the performance security referred to in Sub-Clause 10.1, if any, has been returned to the Contractor.

60.8 **Final Payment Certificate**

Within 30 days after receipt of the Final Statement, and the written discharge, the Engineer shall issue to the Employer (with a copy to the Contractor) a Final Payment Certificate stating:

(a) the amount which, in the opinion of the Engineer, is finally due under the Contract or otherwise, and

(b) after giving credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled other than under Clause 47, the balance, if any, due from the Employer to the Contractor or from the Contractor to the Employer as the case may be.

60.9 **Cessation of Employer's Liability**

The Employer shall not be liable to the Contractor for any matter or thing arising out of or in connection with the Contract or execution of the Works, unless the Contractor shall have included a claim in respect thereof in his Final Statement and (except in respect of matters or things arising after the issue of the Taking-Over Certificate in respect of the whole of the Works) in the Statement at Completion referred to in Sub-Clause 60.5.

60.10 **Time for Payment**

The amount due to the Contractor under any Interim Payment Certificate or final payment issued by the Engineer pursuant to this Clause, or to any other term of the Contract, shall, subject to Clause 47, be paid by the Employer to the Contractor within 30 days after such Interim Payment Certificate or final payment has been delivered to the Employer, provided the work is satisfactory.

61.1 **Approval only by Defects Liability Certificate**

Only the Defects Liability Certificate, referred to in Clause 62, shall be deemed to constitute approval of the Works.

62.1 **Defects Liability Certificate**

The Contract shall not be considered as completed until a Defects Liability Certificate shall have been signed by the Engineer and delivered to the Employer, with a copy to the Contractor, stating the date on which the Contractor shall have completed his obligations to execute and complete the Works and remedy any defects therein to the Engineer's satisfaction. The Defects Liability Certificate shall be given by the Engineer within 30 days after the expiration of the Defects Liability Period, or, if different defects liability periods shall become applicable to different Sections or parts of the Permanent Works, the expiration of the latest such period, or as soon thereafter as any works instructed, pursuant to Clause 49 and 50, have been completed to the satisfaction of the Engineer. Provided that the issue of the Defects Liability Certificate shall not be a condition precedent to payment to the Contractor of the second portion of the Retention Money in accordance with the conditions set out in Sub-Clause 60.3.

62.2 **Unfulfilled Obligations**

Notwithstanding the issue of the Defects Liability Certificate the Contractor and the Employer shall remain liable for the fulfillment of any obligation incurred under the provisions of the Contract prior to the issue of the Defects Liability Certificate which remains unperformed at the time of such Defects Liability Certificate is issued and, for the purposes of determining the nature and extent of any such obligation, the Contract shall be deemed to remain in force between the parties to the Contract.

Remedies

63.1 **Default of Contractor**

If the Contractor is deemed by law unable to pay his debts as they fall due, or enters into voluntary or involuntary bankruptcy, liquidation or dissolution (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), or becomes insolvent, or makes an arrangement with, or assignment in favour of, his creditors, or agrees to carry out the Contract under a committee of inspection of his creditors, or if a receiver, administrator, trustee or liquidator is appointed over any substantial part of his assets, or if, under any law or regulation relating to reorganization, arrangement or readjustment of debts, proceedings are commenced against the Contractor or resolutions passed in connection with dissolution or liquidation or if any steps are taken to enforce any security interest over a substantial part of the assets of the Contractor, or if any act is done or event occurs with respect to the Contractor or his assets which, under any applicable law has a substantially similar effect to any of the foregoing acts or events, or if the Contractor has contravened Sub-Clause 3.1, or has an execution levied on his goods, or Contract, if the Engineer certifies to the Employer, with a copy to the Contractor, that, in his opinion, the Contractor:

(a) has repudiated the Contract, or

(b) without reasonable excuse has failed

(i) to commence the Works in accordance with Sub-Clause 41.1,

(ii) to proceed with the Works, or any Section thereof, within 30 days after receiving notice pursuant to Sub-Clause 46.1,

(c) has failed to comply with a notice issued pursuant to Sub-Clause 37.4 or an instruction issued pursuant to Sub-Clause 39.1 within 30 days after having received it

(d) despite previous warning from the Engineer, in writing, is otherwise persistently or flagrantly neglecting to comply with any of his obligations under the Contract, or

(e) has contravened Sub-Clause 4.1,

then the Employer may, after giving 14 days' notice to the Contractor, enter upon the Site and the Works and terminate the employment of the Contractor without thereby releasing the Contractor from any of his obligations or liabilities under the Contract, or affecting the rights and authorities conferred on the Employer or the Engineer by the Contract, and may himself complete the Works or may employ any other contractor to complete the Works. The Employer or such other contractor may use for such completion so much of the Contractor's Equipment, Temporary Works and materials as he or they may think proper.

63.2 **Valuation at Date of Termination**

The Engineer shall, as soon as may be practicable after any such entry and termination by the Employer, fix and determine ex parte, or by or after reference to the parties or after such investigation or enquiries as he may think fit to make or institute, and shall certify:

(a) what amount (if any) had, at the time of such entry and termination, been reasonably earned by or would reasonably accrue to the Contractor in respect of work then actually done by him under the Contract, and

(b) the value of any of the said unused or partially used materials, any Contractor's Equipment and any Temporary Works.

63.3 **Payment after Termination**

If the Employer terminates the Contractor's employment under this Clause, he shall not be liable to pay to the Contractor any further amount (including damages) in respect of the Contract until the expiration of the Defects Liability Period and thereafter until the costs of execution, completion and remedying of any defects, damages for delay in completion (if any) and all other expenses incurred by the Employer have been ascertained and the amount thereof certified by the Engineer. The Contractor shall then be entitled to receive only such sum (if any) as the Engineer may certify would have been payable to him upon due completion by him after deducting the said amount. If such amount exceeds the sum which would have been payable to the Contractor on due completion by him, then the Contractor shall, upon demand, pay to the Employer the amount of such excess and it shall be deemed a debt due by the Contractor to the Employer and shall be recoverable accordingly.

63.4 **Assignment of Benefit of Agreement**

Unless prohibited by law, the Contractor shall, if so instructed by the Engineer within 14 days of such entry and termination referred to in Sub-Clause 63.1, assign to the Employer the benefit of any agreement for the supply of any goods or materials or services and/or for the execution of any work for the purposes of the Contract, which the Contractor may have entered into.

64.1 **Urgent Remedial Work**

If, by reason of any accident, or failure, or other event occurring to, in, or in connection with the Works, or any part thereof, either during the execution of the Works, or during the Defects Liability Period, any remedial or other work is, in the opinion of the Engineer, urgently necessary for the safety of the Works and the Contractor is unable or unwilling at once to do such work, the Employer shall be entitled to employ and pay other persons to carry out such work as the Engineer may consider necessary. If the work or repair so done by the Employer is work which, in the opinion of the Engineer, the Contractor was liable to do at his own cost under the Contract, then all costs consequent thereon or incidental thereto shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer. Provided that the Engineer shall, as soon after the occurrence of any such emergency as may be reasonably practicable, notify the Contractor thereof.

Special Risks

65.1 **No Liability for Special Risks**

The Contractor shall be under no liability whatsoever in consequence of any of the special risks referred to in Sub-Clause 65.2, whether by way of indemnity or otherwise, for or in respect of:

(a) destruction of or damage to the Works, save to work condemned under the provisions of Clause 39 prior to the occurrence of any of the said special risks,
(b) destruction of or damage to property, whether of the Employer or third parties, or
(c) injury or loss of life.

65.2 **Special Risks**

The Special Risks are:

(a) the risks defined under paragraphs (a), (c), (d) and (e) of Sub-Clause 20.4, and
(b) the risks defined under paragraph (b) of Sub-Clause 20.4 insofar as these relate to the country in which the Works are to be executed.

65.3 **Damage to Works by Special Risks**

If the Works or any materials or Plant on or near or in transit to the Site, or any of the Contractor's Equipment, sustain destruction or damage by reason of any of the said special risks, the Contractor shall be entitled to payment in accordance with the Contract for any Permanent Works duly executed and for any materials or Plant so destroyed or damaged and, so far as may be required by the Engineer or as may be necessary for the completion of the Works, to payment for:

(a) rectifying any such destruction or damage to the Works, and
(b) replacing or rectifying such materials or Contractor's Equipment,

and the Engineer shall determine an addition to the Contract Price in accordance with Clause 52 (which shall in the case of the cost of replacement of Contractor's Equipment include the fair market value thereof as determined by the Engineer) and shall notify the Contractor accordingly, with a copy to the Employer.

65.4 **Projectile, Missile**

Destruction, damage, injury or loss of life caused by the explosion or impact, whenever and wherever occurring, of any mine, bomb, shell, grenade, or other projectile, missile, munition, or explosive of war, outside the reasonable control of the contractor, shall be deemed to be a consequence of the said special risks, provided the same is not in consequence of any lack of diligence on the part of Contractor.

65.5 **Increased Costs arising from Special Risks**

Save to the extent that the Contractor is entitled to payment under any other provision of the Contract, the Employer shall repay to the Contractor any costs of the execution of the Work (other than such as may be attributable to the cost of reconstructing work condemned under the provisions of Clause 39 prior to the occurrence of any special risk) which are howsoever attributable to or consequent on or the result of or in any way whatsoever connected with the said special risks, subject however to the provisions in this Clause hereinafter contained in regard to outbreak of war, but the Contractor shall, as soon as any such cost comes to his knowledge, forthwith notify the Engineer thereof. The Engineer shall, after due consultation with the Employer and the Contractor, determine the amount of the Contractor's costs in respect thereof which shall be added to the Contract Price and shall notify the Contractor accordingly, with a copy to the Employer.

65.6 **Outbreak of War**

If, during the currency of the Contract, there is an outbreak of war, whether war is declared or not, in any part of the world which, whether financially or otherwise, materially affects the execution of the Works, the Contractor shall, unless and until the Contract is terminated under the provisions of this Clause, continue to use his best endeavour to complete the execution of the Works. Provided that the Employer shall be entitled, at any time after such outbreak of war, to terminate the Contract by giving notice to the Contractor and, upon such notice being given, the Contract shall, except as to the rights of the parties under this clause and Clause 67,

terminate, but without prejudice to the rights of either party in respect of any antecedent breach thereof.

65.7 **Removal of Contractor's Equipment on Termination**

If the Contract is terminated under the provisions of Sub-Clause 65.6, the Contractor shall, with all reasonable dispatch, remove from the Site all Contractor's Equipment and shall give similar facilities to his Subcontractors to do so.

65.8 **Payment if Contract Terminated**

If the Contract is terminated as aforesaid, the Contractor shall be paid by the Employer, insofar as such amounts or items have not already been covered by payments on account made to the Contractor, for all work executed prior to the date of termination at the rates and prices provided in the Contract and in addition:

(a) the amounts payable in respect of any preliminary items referred to in the Bill of Quantities, so far as the work or service comprised therein has been carried out or performed, and a proper portion of any such items which have been partially carried out or performed;

(b) the cost of materials, Plant or goods reasonably ordered for the Works which have been delivered to the Contractor or of which the Contractor is legally liable to accept delivery, such materials, Plant or goods becoming the property of the Employer upon such payments being made by him;

(c) a sum being the amount of any expenditure reasonably incurred by the Contractor in the expectation of completing the whole of the Works insofar as such expenditure has not been covered by any other payments referred to in this Sub-Clause;

(d) any additional sum payable under the provisions of Sub-Clauses 65.3 and 65.5;

(e) such proportion of the cost as may be reasonable, taking into account payments made or to be made for work executed, of removal of Contractor's Equipment under Sub-Clause 65.7 and, if required by the Contractor, return thereof to the Contractor's main plant yard in his country of registration or to other destination, at no greater cost; and

(f) the reasonable cost of repatriation of all the Contractor’s staff and workmen employed on or in connection with the Works at the time of such termination.

Provided that against any payment due from the Employer under this Sub-Clause, the Employer shall be entitled to be credited with any outstanding balances due from the Contractor for advances in respect of Contractor's Equipment, materials and Plant and any other sums which, at the date of termination, were recoverable by the Employer from the Contractor under the terms of Contract. Any sums payable under this Sub-Clause shall, after due consultation with the Employer and

the Contractor, be determined by the Engineer who shall notify the Contractor accordingly, with a copy to the Employer.

Release from Performance

66.1 **Payment in Event of Release from Performance**

If any circumstance outside the control of both parties arises after the issue of the Letter of Acceptance which renders it impossible or unlawful for either party to fulfill his or their contractual obligations, or under the law governing the Contract the parties are released from further performance, then the parties shall be discharged from the Contract, except as to their rights under this Clause and Clause 67 and without prejudice to the rights of either party in respect of any antecedent breach of the Contract, and the sum payable by the Employer to the Contractor in respect of the work executed shall be the same as that which would have been payable under Clause 65 if the Contract had been terminated under the provisions of Clause 65.

Settlement of Disputes

67.1 **Engineer's Decision**

If a dispute of any kind whatsoever arises between the Employer and the Contractor in connection with, or arising out of, the Contract or the execution of the Works, whether during the execution of the Works or after their completion and whether before or after repudiation or other termination of the Contract, including any dispute as to any opinion, instruction, determination, certificate or valuation of the Engineer, the matter in dispute shall, in the first place, be referred in writing to the Engineer, with a copy to the other party. Such reference shall state that it is made pursuant to this Clause. No later than the eighty-fourth day after the day on which he received such reference the Engineer shall give notice of his decision to the Employer and the Contractor. Such decision shall state that it is made pursuant to this Clause.

Unless the Contract has already been repudiated or terminated, the Contractor shall, in every case, continue to proceed with the Works with all due diligence and the Contractor and the Employer shall give effect forthwith to every such decision of the Engineer unless and until the same shall be revised, as hereinafter provided, in an amicable settlement or an arbitral award.

If either the Employer or the Contractor be dissatisfied with any decision of the Engineer, or if the Engineer fails to give notice of his decision on or before the eighty-fourth day on which he received the reference, then either the Employer or the Contractor may, on or before the seventieth day after the day on which he received notice of such decision, or on or before the seventieth day after the day on which the said period of 84 days expired, as the case may be, give notice to the other party, with a copy for information to the Engineer, of his intention to commence arbitration, as hereinafter provided, as to the matter in dispute. Such notice shall establish the entitlement of the party giving the same to commence arbitration, as hereinafter provided, as to such dispute and, subject to Sub-Clause 67.4, no arbitration in respect thereof may be commenced unless such notice is given.

If the Engineer has given notice of his decision as to a matter in dispute to the Employer and the Contractor and no notice of intention to commence arbitration as to such dispute has been given by either the Employer or the Contractor on or before the seventieth day after the day on which the parties received notice as to such decision from the Engineer, the said decision shall become final and binding upon the Employer and the Contractor. However, the Blacklisting regime given in section 17-A of PPRA Act, 2009 and rule 21 of PPR-14 read with Schedule appended with the PPR-14 shall have an over-riding effect and shall be applicable in letter and spirit.

67.2 **Amicable Settlement**

Where notice of intention to commence arbitration as to a dispute has been given in accordance with Sub-Clause 67.1, the parties shall attempt to settle such dispute amicably before the commencement of arbitration. Provided that, unless the parties otherwise agree, arbitration may be commenced on or after the fifty-sixth day after the day on which notice of intention to commence arbitration of such dispute was given, even if no attempt at amicable settlement thereof has been made.

67.3 **Arbitration**

Any dispute in respect of which:

(a) the decision, if any, of the Engineer has not become final and binding pursuant to Sub-Clause 67.1, and
(b) amicable settlement has not been reached within the period stated in Sub-Clause 67.2,

shall be finally settled, unless otherwise specified in the Contract, under the Rules of Conciliation and Arbitration of the International Chamber of Commerce by one or more arbitrators appointed under such Rules. The said arbitrator/s shall have full power to open up, review and revise any decision, opinion, instruction, determination, certificate or valuation of the Engineer related to the dispute.

Neither party shall be limited in the proceedings before such arbitrator/s to the evidence or arguments put before the Engineer for the purpose of obtaining his said decision pursuant to Sub-Clause 67.1. No such decision shall disqualify the Engineer from being called as a witness and giving evidence before the arbitrator/s on any matter whatsoever relevant to the dispute.
Arbitration may be commenced prior to or after completion of the Works, provided that the obligations of the Employer, the Engineer and the Contractor shall not be altered by reason of the arbitration being conducted during the progress of the Works.

67.4 **Failure to Comply with Engineer's Decision**

Where neither the Employer nor the Contractor has given notice of intention to commence arbitration of a dispute within the period stated in Sub-Clause 67.1 and the related decision has become final and binding, either party may, if the other party fails to comply with such decision, and without prejudice to any other rights

it may have, refer the failure to arbitration in accordance with Sub-Clause 67.3. The provisions of Sub-Clause 67.1 and 67.2 shall not apply to any such reference.

Notices

68.1 Notice to Contractor

All certificates, notices or instructions to be given to the Contractor by the Employer or the Engineer under the terms of the Contract shall be sent by post, cable, telex or facsimile transmission to or left at the Contractor's principal place of business or such other address as the Contractor shall nominate for that purpose.

68.2 Notice to Employer and Engineer

Any notice to be given to the Employer or to the Engineer under the terms of the Contract shall be sent by post, cable, telex or facsimile transmission to or left at the respective addresses nominated for that purpose in Part II of these Conditions.

68.3 Change of Address

Either party may change a nominated address to another address in the country, where the Works are being executed by prior notice to the other party, with a copy to the Engineer, and the Engineer may do so by prior notice to both parties.

Default of Employer

69.1 Default of Employer

In the event of the Employer:

(a) failing to pay to the Contractor the amount due under any certificate of the Engineer within 30 days after the expiry of the time stated in Sub-Clause 60.10 within which payment is to be made, subject to any deduction that the Employer is entitled to make under the Contract, provided work is satisfactory and the Contractor has not indulged in corrupt or fraudulent practices as defined in rule 2 of PPR-14,

(b) interfering with or obstructing or refusing any required approval to the issue of any such certificate, illegally,

(c) becoming bankrupt or, being a company, going into liquidation, other than for the purpose of a scheme of reconstruction or amalgamation, or

(d) giving notice to the Contractor that for economic reasons it is impossible for him to continue to meet his contractual obligations,

the Contractor may resort to the dispute resolution mechanism given in clauses 67.1 to 67.3 above.

69.2 Removal of Contractor's Equipment

Upon the expiry of the 14 days' notice referred to in Sub-Clause 69.1, the Contractor shall, notwithstanding the provisions of Sub-Clause 54.1, with all reasonable dispatch, remove from the Site all Contractor's Equipment brought by him thereon.

69.3 **Payment on Termination**

In the event of such termination the Employer shall be under the same obligations to the Contractor in regard to payment as if the Contract had been terminated under the provisions of Clause 65, but, in addition to the payments specified in Sub-Clause 65.8, the Employer shall pay to the Contractor the amount of any loss or damage to the Contractor arising out of or in connection with or by consequence of such termination.

69.4 **Contractor's Entitlement to Suspend Work**

Without prejudice to the Contractor's entitlement to interest under Sub-Clause 60.10, if any, the Contractor may, if the Employer fails to pay the Contractor the amount due under any certificate of the Engineer within 30 days after the expiry of the time stated in Sub-Clause 60.10 within which payment is to be made, subject to any deduction that the Employer is entitled to make under the Contract, after giving 30 days' prior notice to the Employer, with a copy to the Engineer, suspend work or reduce the rate of work; provided the previously done work is satisfactory and the Contractor has not indulged in Corrupt practices as given in rule 2 of PPR-14.

If the Contractor suspends work or reduces the rate of work in accordance with the provisions of this Sub-Clause and thereby suffers delay or incurs costs the Engineer shall, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44, and
(b) the amount of such costs, which shall be added to the Contract Price,

and shall notify the Contractor accordingly, with a copy to the Employer.

69.5 **Resumption of Work**

Where the Contractor suspends work or reduces the rate of work, having given notice in accordance with Sub-Clause 69.4, and the Employer subsequently pays the amount due, including interest pursuant to Sub-Clause 60.10, the Contractor's entitlement under Sub-Clause 69.1 shall, if notice of termination has not been given, lapse and the Contractor shall resume normal working as soon as is reasonably possible.

Changes in Cost and Legislation

70.1 **Increase or Decrease of Cost**

There shall be added to or deducted from the Contract Price such sums in respect of rise or fall in the cost of labour and/or materials or any other matters affecting the cost of the execution of the Works as may be determined in accordance with part II of these Conditions.

70.2 **Subsequent Legislation**

If, after the date for submission of tenders for the Contract there occur in the country- in which the Works are being, or are to be, executed- any changes to National or Provincial Statutes, Ordinance, Decree or other Law or any regulation or bye-law of any local or other duly constituted authority, or the introduction of any such State Statute, Ordinance, Decree, Law, regulation or bye-law which causes additional or reduced cost to the Contractor, other than under Sub-Clause 70.1, in the execution of the Contract, such additional or reduced cost shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be added to or deducted from the Contract Price and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

Currency and Rates of Exchange

71.1 Currency Restrictions

If, after the date for submission of tenders for the Contract, the Government or authorized agency of the Government of the country in which the Works are being or are to be executed imposes currency restrictions and/or transfer of currency restrictions in relation to the currency or currencies in which the Contract Price is to be paid, the Employer shall reimburse any loss or damage to the Contractor arising therefrom, without prejudice to the right of the Contractor to exercise any other rights or remedies to which he is entitled in such event. As a principle, payments in foreign currency are not allowed. In exceptional circumstances, payments may only be allowed if all codal formalities have been fulfilled and approval of the Finance department has been obtained and such provision is given in the SCC.

72.1 Rates of Exchange

Where the Contract provides for payment in whole or in part to be made to the Contractor in foreign currency or currencies, such payment shall not be subject to variations in the rate or rates of exchange between such specified foreign currency or currencies and the currency of the country in which the Works are to be executed.

72.2 Currency Proportions

Where the Employer has required the Tender to be expressed in a single currency but with payment to be made in more than one currency and the Contractor has stated the proportions or amounts of other currency or currencies in which he requires payment to be made, the rate or rates of exchange applicable for calculating the payment of such proportions or amounts shall, unless otherwise stated in Part II of these Conditions, be those prevailing, as determined by the Central Bank of the country in which the Works are to be executed, on the date for the submission of tenders for the Contract, as has been notified to the Contractor by the Employer prior to the submission of tenders or as provided for in the Tender.

72.3 Currencies of Payment for Provisional Sums

Where the Contract provides for payment in more than one currency, the proportions or amounts to be paid in foreign currencies in respect of Provisional

Sums shall be determined in accordance with the principles set forth in Sub-Clauses 72.1 and 72.2 as and when these sums are utilized in whole or in part in accordance with the provisions of Clauses 58 and 59.

PART II
SPECIAL CONDITIONS OF CONTRACT

PART II - SPECIAL CONDITIONS OF CONTRACT

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1.1 Definitions

(a) (i) The **Employer** is Punjab Industrial Estates Development & Management Company (PIEDMC), Commercial Area (North), Sundar Industrial Estate, Sundar-Raiwind Road, Lahore represented by its Chief Executive Officer (CEO) and its legal successors and assignees,or any other competent person appointed by the Employer and notified to the Contractor.

(a) (iv) The **Engineer** is General Manager (Technical), Punjab Industrial Estates Development & Management Company (PIEDMC), Commercial Area (North), Sundar Industrial Estate, Sundar-Raiwind Road, Lahore, or any other competent person appointed by the Employer, and notified to the Contractor to act as in replacement of the Engineer. Provided always that except in cases of professional misconduct, the outgoing Engineer to formulate his certifications/recommendations in relation to all outstanding matters, disputes and claims relating to the execution of the Works during his tenure.

"Engineer-In-charge"is synonymous to **"the Engineer**".

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 "**Tende**r" is synonymous with "**Bid**" and the word "**Tender Documents**" with "**Bidding Documents**".

Add the following to Sub-Clause 1.1(b):

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

(b)(x) **"Addendum/ Addenda"** means interpretation of and/or changes in the Tender Documents and understood upon issuance by the Employer to become an integral part of the Bid Documents and the Contract Documents, wherever applicable.

(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 there from as may be made and remedying of any defects therein in accordance with the provisions of the Contract.
Following paragraph is added:

(g)(v) **"Approved by the Engineer"** means approved by the Engineer in writing, including subsequent written confirmation of previous verbal approval and "**approval**" means approval in writing, including as aforesaid.

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 Employer 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) Any action under Clause 10 "Performance Security" and Clauses 21,23,24 & 25 "Insurance" of sorts.

(iii) Certifying additional time and cost determined under Sub-Clause 6.4 "Delay and Cost of Delay of Drawings", Sub-Clause 12.2 "Not Foreseeable Physical Obstructions or Conditions", Sub-Clause 27.1 "Fossil", Clause 40 "Suspension" and Sub-Clause 42.2 "Failure to give Possession".

(iv) Determining extension of time under Clause 44 "Extension of Time for Completion".

(v) Any action under Clause 47 "Liquidated Damages for Delay".

(vi) Issuing a Variation Order under Clause 51,except:

a) in an emergency* situation, as stated herein below, or

b) if such variation would increase the Contract Price by less than the amount stated in the Appendix-A to Bid.

(vii) Certifying additional costs and/or fixing rates or prices under Clause 52.

(viii) Notifying acceptance of principles of claims and/or certifying additional cost under Clause 53 "Procedure of Claims".

(ix) Issuing instructions under Clause 58.

(x) Certifying additional cost under Clause 65.

(xi) Determining additional time and cost under Sub-Clause 17.1 "Setting-out".

(xii) Issuance of "Taking Over Certificate" under Clause 48.

(xiii) Release of Retention Money to the Contractor under Sub-Clause 60.3 "Payment of Retention Money".

* (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 Employer.)

2.2 Engineer's Representative

The following paragraph is added:

The Employer 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 Employer intends to replace the Engineer, the Employer 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 Employer shall not replace the Engineer with a person against whom the Contractor raises reasonable objection by notice to the Employer, with supporting particulars.

4.1 Subcontracting

The text "Except where otherwise provided by the Contract" appearing 1st and 2nd line of the first paragraph and paragraph at Sr. No. (c) of this clause are deleted.

Following is added at the end of this Sub-Clause.
The aggregate amount of parts of the Works subcontracted shall, however, not exceed30% of the Contract Price.

The following Sub-Clauses 4.3 and 4.4 are added

4.3 Approval of Subcontractors

Where a list of Subcontractors is provided under Appendix-I to Bid, the Contractor shall submit qualification documents of these Subcontractors during execution of the Contract to the Engineer for its approval. Any Subcontractor proposed in the list shall be subject to prior approval of the Employer.

4.4 Dispute between Contractor and Subcontractors

In the event of a dispute of whatever nature arises between the Contractor and Subcontractor, the Contractor and Subcontractor shall indemnify the Employer and the

Engineer against such inter disputes, resulting litigations and shall not nominate the Employer or his representative(s) or the Engineer or his representative(s) as "Respondent" or "Witness" in the Court of Law in the process of these litigations. Moreover, the Contractor and the Subcontractor shall continue the Works inspite of such dispute(s).

Affidavit to this effect shall be submitted by the Contractor and his Subcontractors as prerequisite for approval of a Subcontractor(s) under Sub-Clause 4.3 herein above.

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 Forms of Technical Bid and Price Bid;
(4) Addendum (if any)
(5) Special Stipulations (Appendix-A to Bid);
(6) The Particular Conditions of Contract–Part-II;
(7) The General Conditions – Part I;
(8) The pricedBill of Quantities (Appendix–D to Bid);
(9) The completed Appendices to Bid;
(10) The Drawings;
(11) The Specifications; and
(12) Special Provisions.

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.

6.4 Delay and Cost of Delay of Drawings

"/or" is added in the end of the text appearing under (a) after the word "and""determined under Sub-Clause 53.5" is added after the word "Contract Price" appearing in the end of text under (b)

The following Sub-Clauses 6.6, 6.7 and 6.8 are added:

6.6 Details to be Confidential

The Contractor shall treat the details of the Contract as private and confidential, save insofar 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 Employer. 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 Employer whose determination shall be final.

6.7 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.

6.8 As-Built Drawings

At the completion of the Works under the Contract, the Contractor shall furnish to the Engineer six (06) hard copies and one (01) soft copy (editable) 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.

The following Sub-Clauses 8.3 and 8.4 are added;

8.3 Temporary Works

Sufficient details, drawing and calculations pertaining to Temporary Works to demonstrate the adequacy of the Temporary Works shall be submitted by the Contractor not less than fourteen (14) days before the work or the erection of any such Temporary Works commences on the Site.

8.4 Specialists, Suppliers and Subcontractors

Where the Works require the incorporation of proprietary articles manufactured by Specialists, suppliers, or part(s) of the Work involve design or specification matters to be carried out by specialist Subcontractors, the Contractor shall be fully responsible for the outcome in the use of such proprietary articles and for such design and specification executed by Specialist Subcontractors.

9.1 Contract Agreement

The following is added at the end of paragraph:

The Contractor shall provide six (06) copies of signed Contract Agreement to the Employer in proper book form for record. The cost will be borne by the Contractor.

10.1 Performance Security

The text is deleted and substituted with the following:

The Contractor shall provide Performance Security to the Employer in the prescribed form. The said Security shall be furnished or caused to be furnished by the Contractor within 14days after the receipt of the Letter of Acceptance. The Performance Security shall be of an amount equal to 5% of the Contract Price stated in the Letter of Acceptance. Such Security shall be in the form of bank guarantee from any Scheduled Bank in Pakistan.

The cost of complying with requirements of this Sub-Clause shall be borne by the Contractor.

10.2 Period of Validity of Performance Security

In the fifth line of this Sub-Clause, figure "14" is substituted with "28".

Add the following at the end of Sub-Clause;

The Performance Security shall be valid until a date 28 days from the date of issue of the Defects Liability Certificate.

10.3 Claims under Performance Security

Sub-Clause 10.3 is deleted in its entirety.

The following Sub-Clause 10.4 is added:

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.

11.1 Inspection of Site

Add the following at the end of Sub-Clause:

If any data in respect of the above is provided by the Employer, the Contractor is solely responsible for ascertaining the correctness of such data and the Employer shall not be liable in this behalf and no claim whatsoever in nature shall be entertained by the Engineer.

14.1 Programme to be Submitted

The programme shall be submitted within the time stated in Appendix-A to Bid from the date of receipt of Letter of Acceptance.

Add the following at the end of Sub-Clause:

The Contractor shall, within fourteen (14) days from the date of receipt of the Letter of Acceptance, submit to the Engineer for his consent a programme, in such form and detail as the Engineer shall reasonably prescribe, for the execution of the Works. The

Contractor shall, whenever required by the Engineer, also provide in writing for his information a general description of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works.

(a) The Contractor shall submit the Programme of Works on MS Project or Primavera (both hard copy and soft copy) for the agreement of the Engineer and approval of the Employer. All items of works and activities including mobilization should be included in the Programme of Works. The programme shall identify and highlight those activities, which are on the Critical Path. The programme shall be revised monthly and should include a chart of principal activities of the work forecast for monthly execution and an updated schedule of the payment to be made by the Employer to the Contractor. This programme of works as scheduled shall form basis of Liquidated Damages pursuant to Sub-Clauses 47.1 to 47.2.

In addition, cash flow estimates shall be supported with inputs of over drafts organized with financial institutions at various stages of the projects to meet the funding requirements of the project. The Contractor shall supply and maintain at his site office for his and Engineer's use a licensed copy of the project management computer software package namely MS Project or Primavera for programming and to monitor the progress. It shall be supplied complete with manuals and technical training and support for the duration of the Contract as per requirements assessed by the Engineer.

(b) In order to assist the Employer's Project Management Team, the Contractor shall be required to submit at 2 weeks intervals data to the Engineer on the cost and quantities and other data relevant to the monitoring of progress according to a particular format suitable for computer processing.

(c) The programme should be computerized and drawn up on the CPM with all details as illustrated in this Clause, identifying all items of work including temporary work. Progress reporting by the Contractor should be supported on a monthly basis with an up-to-date analysis of the progress including a statement on items, which are or are about to become critical to the progress of the work along with the proposals on how the Contractor intends to alleviate the situation.

General Requirements:

(a) Programme should be submitted (both hard and soft copy) strictly following the guidelines and format specified in this Clause and in Special Provisions.

(b) The Engineer at any time during the execution of the Works; direct the Contractor to change/modify the Programme / Schedule based on the Priority of Works without additional cost to the Employer.

(c) No payment shall be released to the Contractor prior to approval of the Base Line Programme by the Engineer.

(d) Submittal of Programme consists of:
1. Construction Schedule (CPM);
2. Progress Curve/Project Cash Flow;

3. Critical Resources Usage Chart;
4. Detailed Method Statement;
5. Material Procurement Plan;
6. Schedule of Submittals and Shop-Drawings; and
7. Any other details as required by the Engineer.

Construction Schedule:

a. Construction Schedule shall be developed on the basis of Work Breakdown Structure provided or approved by the Engineer.
b. Construction Schedule shall be detailed up to level 4 or as required by the Engineer.
c. Durations of construction activity should be calculated practically in relation to quantity of work done and allocated resources. Any activity that demands duration greater than seven (07) calendar days should be split into number of activities to monitor the same accordingly.
d. Construction activities of the schedule should be logically linked with preceding and succeeding activities and showed in submitted construction schedule.
e. Critical Activities and Critical Path of the Project should be highlighted with red colour in bar chart and precedence diagram. Total Float for non-critical activities should also be shown in the schedule.
f. Appropriate quantity of direct resources (material, labour, equipment and non-consumable material) should be allocated to all activities and showed in submitted construction schedule. Labour resource should be divided according to related trades (e.g. Mason, Operator, helper, etc.) Contractor should make sure that no resource is being over allocated. Indirect resources should be allocated to supervision / summary activity.
g. BOQ amount should be loaded to reach construction activity. Accrual basis should be indicated to construction activity.
h. Construction Schedule should show Activity ID, Activity Description, BOQ Quantity, Duration, Start Date, Finish Date, Total Float, Predecessors, Resource names with quantity, BOQ Amount and timescale where the bars show start and finish dates.

Progress Curve / Projected Cash Flow:

a. Progress Curve / Projected Cash Flow should be developed and presented on Project Management Software – MS Project.

b. S-Curve should be plotted between time (in weeks) and progress of Works done (in % of work). The progress should be shown in cumulative percent of Works done. Percent of Works done should be calculated with the BOQ amount and payment terms.

Critical Resources Usage Chart:

a. Critical Usage Chart should be developed.
b. List of Critical Resources included Labourers, equipments, consumable/non-consumable materials and/or identified by the Engineer.
c. Resource usage chart should show Resource Name and weekly utilization (numbers) of resources on each activity.

Detailed Method Statement:

a. Detailed method statement should be presented in descriptive format explaining the method of carrying out works, logistics, site layout, flow of work, quality and safety measures for each activity and any other details as required by the Engineer.

Material Procurement Plan:

a. Material Procurement Plan for major items of purchase should be presented in a Tabular Format to be submitted to the Engineer for pre-approval. The Plan must as a minimum show the list of local & imported materials to be used, their specification reference, and planned dates for submittal to the Engineer, approval process, placing of order, vendor contact, required delivery on site, status of Line of Credit (LOC) if applicable, and usage of material.

Schedule of Shop Drawings and Submittals:

a. Schedule of Shop Drawings and other Submittals should be presented in a Tabular Format to be submitted to the Engineer for pre-approval. Plan must as a minimum show the list of shop drawings required and their specification reference, planned dates for submittal to consultant, approval process, and usage of shop drawing.

14.3 Cash Flow Estimate to be submitted

The Sub-Clause is amended as follows:

The Contractor shall also submit, with the detailed Programme of Works, to the Engineer for his information a detailed Cash Flow Estimate in monthly periods of all payments to which the Contractor will be entitled under the Contract and the Contractor shall subsequently supply revised Cash Flow Estimates at monthly intervals, if required to do so by the Engineer.

The detailed Cash Flow Estimate shall be submitted within 28 days from the date of receipt of Letter of Acceptance

The following Sub-Clause 14.5 is added:

14.5 Monthly Progress Report

(a) During the period of the Contract, the Contractor shall submit to the Engineer not later than the 8th day of the following month, three (03) 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.

(b) 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. Thedaily record shall include particulars of weather conditions, number of men working, deliveries of materials, quantity, location and assignment of Contractor's equipment.

Following Sub-Clauses 15.2, 15.3 and 15.4 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.

15.4 Provision of In-House Design Review / Check Capabilities of the Contractor

The Contractor is required to associate qualified and experienced technical experts to ensure in-house design review capability to deal with technical problems during construction and shall give prompt notice to the Engineer of any error, omission, fault or other defects in design or specifications of the Works. The final responsibility of practicality and technical adequacy of construction rests with the Contractor.

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 staffs 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 local staff and labour and associated Subcontractors with appropriate qualifications and experience from Pakistan.

19.1 Safety, Security and Protection of the Environment

Add following paragraphs (d), (e), (f) and (g):

(d) The Contractor, to ensure protections of the environment, shall take all necessary measures and precautions in conformity with statutory and regulatory environmental requirements enforced and amended from time to time.

(e) The Contractor shall exercise due care to protect the natural landscape and shall conduct his construction operations so as to prevent any unnecessary destruction, scarring or defacing of the natural surroundings in the vicinity of the Works, except where clearing is required for Permanent Works, Approved Temporary Works and for excavation operations. All watercourses, ponds wells trees and native vegetation shall be preserved and shall be protected from damage, which may be caused, by the Contractor's construction operations and equipment. On completion of the Works, all work areas shall be smoothed and graded in a manner to conform the natural appearance of the landscape. Where necessary, destruction, scaring, damage or defacing may occur as a result of the Contractor's operations, it shall be repaired, replaced, replanted or otherwise corrected at Contractor's expenses to the satisfaction of the Engineer and national and/or provincial Environment Protection Agency.

(f) Borrow areas shall be located and operated so as not to detract from the future usefulness or value of the sites. Upon completion of operations, borrow areas shall be left in a safe and rightly conditions. No borrow area shall be located within 500m from the right of way, except where approved by the Engineer.

(g) During performance of the Work, the Contractor shall carryout proper and efficient measures as often as necessary to reduce the dust pollution.

The following Sub-Clauses 19.3 and 19.4 are added:

19.3 Safety Precautions

In order to provide for the safety, healthand 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 theGovernment of Pakistan with such modifications thereto as the Engineer may authorise or direct and theContractor shall take or cause to be taken such further measures and comply with such further requirements as theEngineer 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 Employer's Risks

The whole text of this Sub-Clause is deleted and substituted with the following:

The Employer's risks are:

(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 Employer 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.

21.1 Insurance of Works and Contractor's Equipment

In para (a) of this Clause, in the first line, after the word "Plant", following words: 'whether provided by the Contractor or the Employer" are added.

Add the following words at the end of Sub-para (a):
"It is being understood that such insurance shall provide for compensation to be payable required to rectify the loss or damage incurred."

21.2 Scope of Cover

Sub-Para (a) of Sub-Clause 21.2 is amended by deleting the words "from the start of work at the Site" and substituting with the words "from the first working day after the Commencement Date."

Following paragraph (c) is added:

(c) It shall be the responsibility of the Contractor to notify the insurance company of any change in the nature and extent of the Works and to ensure the adequacy of the insurance coverage at all times during the period of the Contract.

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).

23.2 Minimum amount of Third Party Insurance

Per occurrence with number of occurrence unlimited:

i) For property, full repair cost or full replacement cost, as the case may be, per occurrence with the number of occurrence unlimited.
ii) in case of death, Pak Rs. 1,000,000/- per person
iii) in case of major injury, Pak Rs. 500,000/- per person
iv) in case of minor injury, PakRs. 100,000/- per person

24.2 Insurance Against Accident to Workmen

The Workmen compensation Policy must contain following conditions of indemnification per occurrence with the number of occurrence unlimited:

i) in case of death, Pak Rs. 1,000,000/- per person
ii) in case of major injury, Pak Rs. 500,000/- per person
iii) in case of minor injury, Pak Rs. 100,000/- per person

25.1 Evidence and Terms of Insurances

Sub-Clause 25.1 is amended by inserting the words "as soon as practicable after the respective insurances have been taken out but in any case" before the words "prior to the start of work at the Site."

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 having at least A rating from PACRA or JCR-VIS and acceptable to the Employer.

Costs of such insurances shall be borne by the Contractor.

27.1 Fossils

"/or" is added in the end of the text appearing under (a) after the word "and".

"determined under Sub-Clause 53.5" is added after the word "Contract Price" appearing in the end of first line of text under (b).

30.3 Transport of Material or Plant

The whole text of this Sub-Clause is deleted and substituted with the following:

If, notwithstanding Sub-Clause 30.1 any damage occurs to any bridge or road communicating with or on the routes to the Site arising from the transport of materials or Plant, the Contractor shall notify the Engineer with a copy to the Employer, as soon as he becomes aware of such damage or as soon as he receives any claim from the authority entitled to make such claim.

The Employer shall not be liable for any costs, charges or expenses in respect of any damage occurs to any bridge or road arising from the transport of materials or Plant by the Contractor. The Contractor shall keep indemnified the Employer against all such claims. The Contractor shall negotiate the settlement of claim with the authority and pay all sums due in respect of all claims, proceeding, damages, costs, charges and expenses.

The Contractor shall notify the Engineer and Employer about the negotiations, in-respect of settlement of claim. In case of failure in payment of claimed amount by the Contractor, the Employer shall recover the amount of claim from the Contractor by making deduction from any monies due or to become due to the Contractor and shall notify the Contractor accordingly.

Following Sub-Clause 30.5 is added:

30.5 Extraordinary Traffic

Nothing contained above shall excuse the Contractor or any of his Subcontractor(s) from complying with state laws regulating traffic on highway and bridges.

Following Sub-Clause 31.3 is added:

31.3 Co-operation with other Contractors

During the execution of the Works, theContractor shall co-operate fully with other contractors working for the Employer 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 34.19 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 theWork is carried out. Inthe absence of any Rates of Wages or Conditions of Labourso 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 employers 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 Employer or the Engineer; except with the prior written consent of the Employer 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 Employer or if the Employer 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 thesatisfaction 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, barter, or otherwise dispose of, to any person or persons, any arms or ammunition of any kind or permit or suffer the same as aforesaid except to those who are employed or hired for security of the work, Plant & Equipment, Material, Camp Sites, Offices, Housing including Employer's/Engineer's facilities, etc.

34.10 Festivals and Religious Customs

The Contractor shall in all dealings with his staff and labour have due regard to all recognized 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 neighborhood of the Works against the same.

34.12Repatriation of Labour

The Contractor shall be responsible for the return to the place of recruitment or domicile of all persons recruited and employed for the purpose of or in connection with the Contract, and shall maintain suitable accommodation and amenities for such persons until they have left the site.

34.13 Measures against Insect and Pest Nuisance

The Contractor shall at all times take the necessary precautions to protect all staff and labour employed on the Site from insect nuisance, rats, and other pests and reduce the danger to health and the general nuisance caused by the same. The Contractor shall provide his staff and labour with suitable prophylactics for the prevention of malaria and shall take steps to prevent the formation of stagnant pools of water. He shall comply with all the regulations of the local health authorities in these respects and shall in particular arrange to spray thoroughly with approved insecticide all buildings erected on the Site. Such treatment shall be carried out at least once a year or as instructed by the Engineer. The Contractor shall warn his staff and labour of the dangers of bilharzias and wild animals.

34.14 Burial of the Dead

The Contractor shall make any necessary arrangements for the transport, to any place as required for burial, of any of his expatriate employees or members of their families who may die in Pakistan.The Contractor shall also be responsible, to the extent required by the local regulations, for making any arrangements with regard to burial of any of his local employees who may die while engaged upon the Works.

34.15 Supply of Foodstuffs

The Contractor shall arrange for the provision of a sufficient supply of suitable food at reasonable prices for all his staff and labour for the purposes of or in connection with the Contract.

34.16 Accident Prevention Officer

The Contractor shall depute for his staff, at the site, an officer dealing only with questions regarding the safety and protection against accidents of all staff and labour. This officer shall be qualified for this work and shall have the authority to issue instructions and shall take protective measures to prevent accidents. Adequate number of Site Safety Inspectors shall be deployed by Contractor to assist Accident Prevention Officer and ensure safety of workers in the hazardous work areas.

34.17 First Aid Facilities

The Contractor shall provide and maintain adequate First Aid Facilities convenient to the Site to the approval of the Engineer.

34.18 Dangerous Materials

The Contractor and his subcontractors shall convey, store and make use of all explosives, dangerous petroleum, acetylene, carbide of calcium and other similar material provided by them for use in or on the Works in strict accordance with the provision of all laws, orders and regulations that are in force at the site or may be issued from time to time by the Government.

34.19 Compliance by Subcontractors

The Contractor shall be responsible for compliance by his Subcontractors of the provisions of this Clause 34.

Add following Sub-Clauses 35.2 and 35.3:

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.

36.5 Engineer's Determination where Test not provided for

"/or" is added in the end of the text appearing under (a) after the word "and"

"determined under Sub-Clause 53.5" are added after the word "Contract Price" appearing in the end of first line of text under (b)

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.

40.2 Engineer's Determination following Suspension

Add "/or" in the end of the text appearing under (a) after the word "and"
Add "determined under Sub-Clause 53.5" after the word "Contract Price" appearing in the end of first line of text under (b)

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.

42.2 Failure to give Possession

"/or"are added in the end of the text appearing under (a) after the word "and"

"determined under Sub-Clause 53.5" are added after the word "Contract Price" appearing in the end of first line of text under (b).

Add the following Sub-Clause 47.3

47.3 Advance Liquidated Damages

The assessment of progress of Works shall be performed at an interval of two (02)

months, for the execution of the Works. If the Contractor's programme is not as per approved schedule of works for the consecutive three intervals, the Contractor shall be liable for advance liquidated damages at the rate of 0.025% per day delay up to a maximum of 5% of Contract Price stated in the letter of Acceptance which may be refunded if the progress again matches the approved work schedule any time during the execution of the Works.

The amount of advance liquidated damages deducted by the Employer from the invoices of the Contractor and not refunded, under the Sub-Clause shall be taken into consideration while determining the Contractor's liability under clause 47.1 and 47.2.

If the work is observed to be behind approved schedule in the four consecutive intervals, then the Employer may invoke Sub-Clause 63.1.

48.1 Taking-Over Certificate

The following is added after the word "-------Works" in the 7th line;
Within 14 days of the date of receipt of the Contractor's notice for issuance of Taking-Over Certificate, the Employer shall on the written request by the Engineer, constitute a committee comprising of Engineer/Engineer's Representative, Employer's and Contractor's Representatives. The committee shall conduct a detailed inspection of the Works completed by the Contractor to ascertain the completion or the extent of completion to decide about the issuance of Taking-Over Certificate, or otherwise.

48.2 Taking-Over of Sections or Parts

The whole of the Works are to be completed within the Time for Completion stated in Appendix-A to Bid. As such noTaking Over Certificate(s) will be issued for any part of the Works substantially completed.

49.2 Completion of Outstanding Works and Remedying Defects

At the completion of the Defects Liability Period, the Employer shall constitute a committee comprising of Engineer/Engineer's Representative, Employer's and Contractor's Representatives. The committee shall conduct a detailed inspection of the Works to ascertain that the Contractor has completed all the outstanding Works and remedied the defects.

Add following Sub-Clause 49.5:

49.5 Extension of Defects Liability Period

The defects liability period for the Works shall be extended by a period equal to the period during which the Works cannot be used by reason of defect or damage. If only part of the Works is affected, the Defect Liability Period shall be extended only for that part. In neither case shall the Defects Liability Period extend beyond two (02) years.

51.1 Variations

Add the following para at the end of this Sub-Clause:

The approval / finalization of rates of all variations shall not relieve the Contractor of his obligations under the Contract. The Contractor shall neither stop the work nor slow down progress of the Works in awaiting the approval of rates of all variations.

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 28 days from the date of disagreement whichever is later.

Contractors overhead and profit including all taxes for valuation of variations of items that are not covered in Bill of Quantities are mentioned in Appendix A.

52.2 Power of Engineer to fix Rates

In third line after the word “Contract” the word “and Market Rate System (MRS)2021, 1stBi-annual” shall be added.

52.3 Variations Exceeding 15 Percent

Replace 15% with 25% where ever appeared in this Sub-Clause.

53.3 Substantiation of Claims

The words “and approved by the Employer” are added in the 2nd line after the word “Engineer”.

The words “but not more than 28 days” are added in the end of seventh line after the word “require”.

The text “if required by the Engineer so to do” appearing in the second last line.

53.4 Failure to Comply

This Sub-Clause is deleted in its entirety and replace with following:

The Contractor shall not be entitled for any payment in respect of the claim(s) if the Contractor fails to comply with the requirements or any of the requirement of Sub-Clause 53.1, 53.2 and 53.3 within the time period stipulated therein the Clauses mentioned above and or fails in keeping and producing necessary records whenever demanded by the Engineer.

53.5 Payment of Claims

Add following as Para 1 to this Sub-Clause:

Within 56 days after receiving a claim and any further particulars supporting a previous claim, the Engineer shall respond with approval, or with disapproval and detailed comments. He may also request any necessary further particulars, but shall nevertheless give his response on the principles of the claim within such time with a copy to the Employer.
Add the following at the end of this Sub-Clause 53.5:

not later than forty two (42) days after receiving the claim and the supporting particulars as per Sub-Clause 53.3

54.1 Contractor's Equipment, Temporary Works, and materials; Exclusive use for the Works

Add following paragraph at the end of Sub-Clause:

The Contractor shall forward to the Engineer at the end of each month returns showing the Construction Plant, Material, etc., on Site in a form prescribed by the Engineer.

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.

Add following Sub-Clause 55.2:

55.2 Omission of Quantities

Items of works described in the Bill of Quantities for which no rate or price has been entered, cost of these items shall be deemed included in other rates and prices in the Contract and will not be paid for separately by the Employer.

The whole cost of complying with the provisions of the Contract shall be included in the items provided in the Bill of Quantities, and where no items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.

57.1 Method of Measurement

Delete Sub-Clause 57.1 and replace with following:

The measurement of the Works shall be performed on the basis of the Specifications. All works completed under the Contract shall be measured according to the FPS system for all items, unless otherwise provided herein or in the Special Provisions. The Works shall be measured notwithstanding any general or local custom except where otherwise specifically described or prescribed in the Contract.

Following Sub-Clause 57.3 is added:

57.3 Copies of Payment Certificate

The Contractor will supply to the Engineer's Representative six (6) copies of the abstract of Contractor's certificate of payment every month along with two copies of detailed measurements, quality control tests and cross sections with calculations, and any other document or information which form the basis of payment.

58.2 Use of Provisional Sums

Paras (a) and (b) of this Sub-Clause are deleted and replace with following:

(a) the Contractor under Part1 of Bill No. 8, in which case the Contractor shall be entitled to an amount equal to the value thereof determined in accordance with Clause 52, and

(b) the Contractor under Part 2 of Bill No. 8, in which case the Contractor shall be entitled to the actual price paid or due to be paid by the Contractor (without any overhead charges and profit)

Add following Sub-Clauses59.4 and 59.5:

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 Employer 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 Employer, the amount which the nominated Subcontractor was directly paid by the Employer.

60.1 Monthly Statements

Delete Sub-Clause 60.1 and replace with following:

The Contractor shall submit six (06) copies of the statement to the Engineer at the end of each month, in a tabulated form approved by the Engineer, showing the amounts to which the Contractor considers himself to be entitled. The statement shall include the following items, as applicable, which shall be taken into account in the sequence listed:

(a) the estimated Contract value of the Permanent Works executed up to the end of the month in question, determined in accordance with Sub-Clause 56.1, at the unit rates and prices included in the Contract;

(b) the actual value certified for payment for the Permanent Works executed up to the end of the previous month, at the unit rates and prices included in the Contract;

(c) the estimated Contract value at the unit rates and prices included in the Contract of the Permanent Works for the month in question, obtained by deducting (b) from (a);

(d) the equivalent of the amount set forth in (c), expressed in the various currencies (if applicable) in which the Contract Price is payable, and calculated by applying the proportions and the exchange rates set forth in the Appendix to Bid to the amount set forth in (c);

(e) the value of any variations executed up to the end of the month in question, less the amount certified in the previous Interim Payment Certificate, expressed in the relevant amounts of foreign (if applicable) and local currencies, pursuant to Clause 52;

(f) amounts approved in respect of day work executed up to the end of the month in question, less the amount for day work certified in the previous Interim Payment Certificate, as determined from the day workschedule of the Bill of Quantities;

(g) amounts reflecting changes in cost and legislation, pursuant to Clause 70;

(h) any credit or debit for the month in question in respect of materials for the Permanent Works, in the relevant amounts, and under the conditions set forth in Sub-Clause 60.11;

(i) any amount to be withheld under the retention provisions of Sub-Clause 60.3, determined by applying the percentage set forth in Sub-Clause 60.3;

(j) any amounts to be deducted as recovery of the advance under the provisions of Sub-Clause 60.13;

(k) adjustment of any other sum, expressed in the applicable currency or currencies, to which the Contractor may be entitled under the Contract or to be recovered from the Contractor; and

(l) any amounts to be deducted as withholding tax and any other applicable taxes under the provisions of Income Tax Laws, Central Board of Revenue and Provincial Revenue regulations.

TheContractorshallensurethatalltheguaranteesrequiredundertheContractshallrenewedfromtimetotime(ifrequired)andshallremainvalidandenforceableuntiltheContractorhassuccessfullydischargedhisobligationsundertheContractandrecoveryofmobilizationadvancehasbeenmade.

60.2 Monthly Payments

Sub-Clause 60.2 is deleted and replaced with following:

The said statement shall be approved or amended by the Engineer in such a way that, in his opinion, it reflects the amount due to the Contractor in accordance with the Contract, after deduction, other than pursuant to Clause 47, of any sums which may have become due and payable by the Contractor to the Employer. In cases where there is a difference of opinion as to the value of any item, the Engineer's view shall prevail. Within 14 days of receipt of the monthly statement referred to in Sub-clause 60.1, the Engineer shall determine the amounts due to the Contractor and shall issue to the Employer and the Contractor a certificate herein called "Interim Payment Certificate", certifying the amounts due to the Contractor.

The Engineer shall not be bound to certify any payment under this Sub-Clause if the net amount thereof, after all retention and deductions, would be less than the Minimum Amount of Interim Payment Certificates stated in the Appendix-A to Bid. However, in such case, the unpaid certified amount will be added to the next interim payment, and the cumulative unpaid certified amount will be compared to the minimum amount of interim payment

Notwithstanding the terms of this Clause or any other Clause of the Contract, no amount will be certified by the Engineer for payment until the Performance Security has been provided by the Contractor and approved by the Employer".

60.3 Payment of Retention Money

Retention Money shall be 5% of the sum stated in Letter of Acceptance. From each Interim Payment Certificate of the Contractor, 7 % of amounts certified under Clause 60.2 shall be retained until the amounts so retained reach 5% of the Contract Price stated in the Letter of Acceptance.

Notwithstanding anything above, the retention shall be affected in local currency only from the local currency portion of payments and shall also be released the same way in local currency.

60.6 Final Statement

Add following paragraph at the end:

If, following discussions between the Engineer and the Contractor and any changes to the draft final statement which may be agreed between them, it becomes evident that a

dispute exists, the Engineer shall issue to the Employer an Interim Payment Certificate for those parts of the draft final statement which are not in dispute. The dispute shall then be settled in accordance with Clause 67. The Final Statement shall be agreed upon settlement of the dispute.

60.8 Final Payment Certificate

Delete the words "other than under Clause 47" from para (b) line 2 and 3

Add the following Para at the end of this Sub-Clause:
The Contractor shall also submit the following documents with his final statement to the Engineer:

(a) Approved final As-built drawings; and

(b) An affidavit by the Contractor that the Works have been executed according to approved specifications, drawings, designs and standard and have not concealed defects known to him.

60.10 Time for Payment

Delete the text and substitute:

The amount due to the Contractor under any Interim Payment Certificate issued by the Engineer pursuant to this Clause, or to any other terms of the Contract, shall, subject to Clause 47, be paid by the Employer to the Contractor within 28 days after such interim certificate has been delivered to the Employer, or, in the case of the Final Certificate referred to in Sub Clause 60.8, within 28 days, after such Final Payment Certificate has been delivered to the Employer.

All payments to the Contractor shall be made in Pak Rupees only under the Contract. No payments in foreign currency are admissible.

Following Sub-Clauses 60.11 to 60.13 are added:

60.11 Secured Advance on Materials

No secured advance will be allowed throughout the currency of Contract.

60.12 Mode of Payment

Payments to the Contractor by the Employer shall be made thorough cross cheque.

60.13 Financial Assistance to Contractor

Provision is made within the Contract for the Contractor to obtain an interest free Mobilization Advance. The advance shall be limited to and will cover mobilization, demobilization and any costs incurred therein by the Contractor. Financial assistance shall be made available to the Contractor by the Employer by adopting the following methodology:

(a) An interest free Mobilization Advance stated in Appendix –A to Bid (if opted by the Contractor) shall be paid against unconditional, irrevocable, bank guarantee acceptable to the Employer in two equal parts after the following conditions have been fulfilled.

Part-1: 50% of the total amount of the Mobilization Advance

- That the Contract Agreement has been signed by the Parties.
- The Contractor has submitted bank guarantee for the full amount of the advance payment in the form of bank guarantee.
- The Contractor has submitted the Performance Security in the form as prescribed in Sub-Clause 10.1.

Part-2: Remaining 50% of the total amount of the Mobilization Advance shall be paid on mobilization of resources at the Site by the Contractor to the satisfaction of the Engineer within 42 days from the date of payment of the first part.

(b) The bank guarantee must be issued by a scheduled bank in Pakistan acceptable to the Employer and must be en-cashable in Pakistan. The bank guarantee shall remain valid and enforced until the Mobilization Advance is recovered in full.

(c) At any time, the bank guarantee shall be valid for an amount not less than the amount of the original Mobilization Advance less any partial repayment of that Advance which may have been affected. The Contractor shall inform the guaranteeing bank, by letter, counter signed by the Employer, of the required amount of the guarantee from time to time. Reduction of the amount shall not be made without such authorizing letter.

(d) The deductions shall commence in the next Interim Payment Certificate following that in which the total of all certified interim payments (excluding the advance payment and deductions and repayments of retention) exceeds fifteen percent (15%) of the Contract Price less Provisional Sums. The deductions shall be made at the amoritization rate of 15% of the amount of each Interim Payment Certificate (excluding the advance payment and deductions for its repayments as well as deductions for retention money) until such time as the advance payment has been repaid; provided that the advance payment shall be completely repaid prior to the time when ninety percent (90%) of the Contract Price less Provisional Sums has been certified for payment.

(e) The Employer shall be empowered to call in the guarantee in whole or in part(s) if the Contractor defaults in the repayment(s) for any reason(s).

63.1 Default of Contractor

Add following as paragraph (b) (iii):

If the progress of the works with respect to the Programme of Works is observed to be behind the approved program of works against agreed three consecutive months.

Delete the last paragraph of this sub-clause and substitute with:

"then the Employer may, after giving 14 days' notice to the Contractor, enter upon the Site and expel the Contractor there from without thereby voiding the Contract, or releasing the Contractor from any of his obligations or liabilities under the Contract, or affecting the rights and powers conferred on the Employer or Engineer by the Contract, and may himself complete the works or may employ any other Contractor to complete the Works. The Employer or such other Contractor may use for such completion so much of the Contractor's Equipment, Plant, Temporary Works, and materials, which have been deemed to be reserved exclusively for the execution of the Works, under the provisions of the Contract, as he or they may think proper and the Employer may, at any time, sell any of the said Contractor's Equipment, Temporary Works, and unused Plant and material, forfeit Performance Security and apply the proceeds of sale in or toward the satisfaction of any sums due or that may become due to him from the Contractor under the Contract."

Provided further that in addition to the action taken by the Employer against the Contractor under this Clause, the Employer 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.

Following Sub-Clause 63.5 is added:

63.5 Corrupt and fraudulent Practices

If in the judgment of the Employer, the Contractor has engaged in corrupt or fraudulent practices, in competing for or in executing the Contract, then the Employer may, after having given 14 days notice to the Contractor, terminate the Contractor's employment under the contract and expel him from the Site, and the provision of Clause 63 shall apply as if such expulsion had been made under Sub-Clause 63.1.

For the purpose of this Sub-Clause:

"Corrupt practice" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution.

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

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) hereof.

67. 3 Arbitration

In the sixth to eight lines, the words "shall be finally settled ..... appointed under such Rules" are deletedand 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 Lahore, 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 Employer 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 Employer and Engineer

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

a) The Employer
Chief Executive Officer (CEO)

Punjab Industrial Estates

Development & Management Company (PIEDMC)

Commercial Area (North), Sundar Industrial Estate

Sundar-Raiwind Road, Lahore

Tel: 042-35297203-6

Fax: 042-35297207

b) The Engineer
General Manager (Technical)
Punjab Industrial Estates Development & Management Company (PIEDMC)

Commercial Area (North), Sundar Industrial Estate, Sundar-Raiwind Road, Lahore.

Tel: 042-35297203-6

Fax: 042-35297207

69.4 Contractor's Entitlement to Suspend Work

"/or"are added in the end of the text appearing under (a) after the word "and".

Add "determined under Sub-Clause 53.5 are added" after the word "Contract Price" appearing in the first line of text under (b)

70.1 Increase or Decrease of Cost

Sub-Clause 70.1 is deleted in its entirety, and substituted with the following:

(1) Where any variation (increase or decrease), to the extent of 5% or more, in the price of any of the item mentioned in sub-clause (2) below takes place after the acceptance of tender and before the completion of contract, the amount payable under the contract shall be adjustable to the extent of the actual variation in the cost of the item concerned.

(2) No price variation under this clause shall be admissible except in respect of the

following items: -

(i) Cement
(ii) Steel
  (a) M.S. Bars (Plain and deformed)
  (b) M.S. Sections
  (c) High Tensile Steel Wire
  (d) M.S. and G.l. Pipes
  (e) M.S & G.I Sheet
  (f) C.I Specials
(iii) Asbestos Cement Pipes
(iv) P.V.C. Pipes/uPVC Pipes
(v) PPRC Pipes
(vi) HDPE Pipes
(vii) R.C.C/P.C.C. Pipes
(viii) Bitumen
(ix) High Speed Diesel
(x) Bricks
  (a) 1st Class Bricks
  (b) Tiles
  (c) Gutka
(xi) Stone aggregates
  (a) Stone metal for Sub Base
  (b) Stone metal for Base Course
  (c) Crushed bujri
(xii) Harrow Sand
(xiii) Tiles (Ceramics and Porcelain)
(xiv) Wood
(xv) Aluminum Sections
(xvi) Paint (interior & exterior)
(xvii) Labour

(3) The base price for the purposes of calculation of the price variation shall be the price prevalent in the month during which the last day of the submission of tender falls.

(4) The price variation under this clause shall be worked out on the basis of the price of the particular item prevalent in a particular district on the 1st day of each month as per price list of such manufacturers or suppliers at such places as are notified by the Finance Department Government of the Punjab from time to time. The prices of the manufacturers or suppliers at the place(s) so notified shall be applicable to the particular district or the entire Punjab (where district-wise list of manufacturers or suppliers has not been notified)

(5) If no notification in respect of any of the item mentioned in sub clause (2) is issued

under sub-clause (4) no price variation shall be admissible in respect of that item during that month.

(6) The amount payable or deduct able in respect of item No. (i) to (x) of sub clause 2, shall be calculated on the basis of the quantity actually consumed on the work during the month.

(7) The amount payable or deductable in respect of item No. (v) of sub-clause (2) shall be calculated on the basis of the actual quantity of cement and steel bars used in the manufacture of the pipes during the month.

(8) No escalation shall be allowed to the contractor in respect of the period extended for the completion of the work due to his own fault.

(9) If, under the existing codal rules, secured advance is paid on all or any of the imperishable items in sub-clause (2) above, price variation shall be admissible on such item(s) in respect of the quantity or quantities for which secured advance has been paid to the contractor, however, price variation will be paid after actual consumption of the material but rate to calculate the price variation would be period when material was brought at the Site.

(10) The increase or decrease in the contract price subsequent to any increase or decrease in the cost of high speed diesel shall be calculated from the increase or decrease in the basic price of high speed diesel using the following formula:

Increase or decrease = α x VOW x (CPD-BPD)/BPD in contract price where:

VOW= the value of the work, including the value of any additional items for which payment has been certified by the Engineer-In-charge, executed subsequent to such increase or decrease in the Basic Price as shall be obtained by apply the unit rates, and prices entered in the measurement book.

CPD= Current price of high speed diesel, and
BPD= Basic price of high speed diesel.
Factor $\alpha = 0.15$ for Highway / Road Works
$\alpha = 0.07$ for Buildings Works

(11) The increase or decrease in the contract price subsequent to any increase or decrease in the cost of labour shall be calculated from the increase or decrease in the basic price of labour using the following formula:

Increase or decrease = β x VOW x (CLR-BLR)/BLR in the contract price. Where

VOW = the value of the work for which payment has been certified by the Consultants, executed subsequent to such increase or decrease in the Basic Price as shall be obtained by applying the approved unit rates and prices entered in the payment certificate (measurement book).

CLR = Current labour rates for unskilled workers (as published by Bureau of Statistics, Govt. of Pakistan)

BLR = Basic labour rates for unskilled workers as on the date of receipt of tenders (as published by Bureau of Statistics, Govt. of Pakistan)

Factor $\beta = 0.15$ both for Building & Road works

Adjustment after Completion

If the Contractor fails to complete the Works within the Time for Completion prescribed under Clause 43, price variation thereafter until the date of completion of the Works shall be made using either the indices or prices relating to the prescribed time for completion, or the current indices or prices, whichever is more favorable to the Employer, provided that if an extension of time is granted pursuant to Clause 44, the above provision shall apply only to price variation made after the expiry of such extension of time.

71&72 Currency and Rates of Exchange

Whole Clauses 71.1, 72.1, 72.2 and 72.3 are deleted as the currency of payment is Pak Rs. only.

Following Sub-Clauses 73.1, 73.2, 74.1, 75.1, 76.1, 77.1, 78.1, 79.1, 80.1, 81.1, 82.1 and 83.1 are added:

73.1 Cost Inclusive of Duties and Taxes

Local Taxation

The priced bid by the Contractor shall include all customs duties, import duties, business taxes, and income and other taxesincluding Provincial Sales Tax on servicesthat may be levied in accordance with the laws and regulations in being on the date 28 days prior to the latest date for submission of bids in the Employer's country on the Contractor's Equipment, Plant, materials, and supplies (permanent, temporary, and consumable) acquired for the purpose of the Contract and on the services performed under the Contract. Nothing in the Contract shall relieve the Contractor from his responsibility to pay any tax that may be levied in the Employer's country on profits made by him in respect of the Contract.

Foreign Taxation (If any)

The priced bid by the Contractor shall include all taxes, duties, and other charges imposed outside the Employer's country on the production, manufacture, sale, and transport of the Contractor's Equipment, Plant, materials, and supplies to be used on or furnished under the Contract, and on the services performed under the Contract.

73.2 Income Tax Provision in Sub-Contracts

Provisions to the like effect as those contained in this Clause shall be incorporated by the Contractor in all sub-contract(s).

Advance Income Tax

Deduction of advance income tax/withholding tax from the payable bill amount shall be made in accordance with the prevalent Income Tax Laws of Government of Pakistan. These deductions shall be deposited, in the Government Treasury by the Employer, to the account of Contractor.

The Employer shall within 28 days of making any such deduction provide to the Contractor a certificate of tax deducted.

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 to his Bid, then the Employer shall be entitled to:

a. recover from the Contractor an amount equivalent to ten times the sum of any commission, gratification, bribe, finder's fee or kickback given by the Contractor or any of his Subcontractors, agents or servants;
b. terminate the Contract; and
c. recover from the Contractor any loss or damage to the Employer as a result of such termination or of any other corrupt business practices of the Contractor or any of his Subcontractors, 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 Employer under Sub-Para (a) and (c) of this Sub-Clause.

75.1 Termination of Contract for Employer's Convenience

The Employer shall be entitled to terminate the Contract at any time for the Employer'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 Employer 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 Employer 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 Employer 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 Employer.

78.1 State of Emergency

In addition to other responsibilities under the Contract the Contractor shall comply with any police or Military Regulations, orders or instructions in force in the area of the Works due to a State of Emergency.

79.1 Personal Liabilities

Neither any member of the Employer's staff, nor the Engineer nor any member of his staff, nor the Engineer's Representative shall be in any way personally liable for the act or obligations under the Contract, or answerable for any default or omission on the part of the Contractor in the observance of the provisions of the Contract or performance of any of the act matters or things which are herein contained.

80.1 Acquisition of Land and Relocation of Utilities

The acquisition of land within the Right of Way and the relocation of utilities from the Right of Way shall be the Employer's responsibility and in order to allow commencement and execution of the Works on Site in accordance with a programme approved by the Engineer sufficient "Right of Way (ROW)" as per Sub-Clause 42.1 shall be handed over to the Contractor clear of all encumbrances.

The Contractor shall conduct his operations, make necessary arrangements, take suitable precautions and perform all required Works incident to the protection of and avoidance of interference with power transmission, telegraph and natural gas lines, oil lines, water and sewerage mains and other utilities within the areas of his operations in connection with this Contract. If any harm/ damage is done to the existing utility lines/ services because of the Contractor Works, the cost thereof shall be borne by the Contractor. The Contractor shall save harmless and indemnify the Employer in respect of all claims, demands, proceedings, damages, costs, charges and expenses whatsoever arising out of or in relation to any such operations or interference.

81.1Wastage

No payment shall be made under any circumstances for wastage of materials, supplies and/or fixtures supplied by the Contractor. In all cases payment shall be made only on the basis of the net quantities of work done. It is up to the Contractor to calculate and make allowance for any or all such wastage (e.g. cut ends of reinforcement bars, spillage of cement and the like) in establishing the unit rates or prices for the items of works.

82.1 Dealing with Water

The Contractor shall take all necessary measures to prevent water from the Site causing a nuisance on or, in any neighboring land or property either by causing flooding or by depositing sediment on the surface of the ground or in drains or watercourses. Wherever necessary to prevent this, the Contractor shall construct temporary drainage channels, layer sumps and traps (in addition to those shown on the Contract) discharging into existing drain, ditches or watercourses. The Contractor snail removes over all sediment, which may accumulate on any land or in any drains, ditches or watercourses or in any other property as a result of his operations.

All works including those below sub-soil standing water level shall be carried out in the dry unless specified otherwise. The Contractor's arrangements for controlling the inflow of water into the parts of the excavation being worked and during the placing of concrete and other works therein and for the collection and disposal of water shall be to the Engineer's Approval. Such arrangements may include interalia temporary cofferdams, well-point systems, pumps; drains trenches, flumes and other recognized means. All Costs and charges in dealing with water in any way whatsoever and the effects thereof will be deemed to be included in the Contract Price and in the unit rates or prices of the Contractor for excavations.

Water flowing into excavations shall be carried by trenches, drainage layers or open jointed drains to sumps from which it shall be pumped. Such trenches drains or sands shall generally be clear of the Permanent Works unless approved otherwise by the Engineer. If, with the said Approval of the Engineer trenches drains or sumps are excavated under or immediately adjacent the Permanent Works, these shall comprise open-jointed pipes with gravel mounds. When no longer required and when approved by the Engineer they shall be filled with a cement /sand grout injected under pressure so as to fill the pipe and all voids completely.

The Contractor shall keep all surfaces upon or against which concrete is to be deposited free from running water and no concrete shall be placed until such surfaces are properly drained. Suitable precautions shall be taken to prevent running water from washing out cement or concrete while it is setting or from injuring the Works in any other way.

Notwithstanding the Approval by the Engineer of the Contractor's methods of dealing with water, the Contractor shall be responsible for and accept all the risks and liabilities of dealing with water from whatever source and of all effects thereof.

83.1 Punjab Procurement Rules-2014

Notwithstanding anything contained in the Bidding/ Contract Documents, the Punjab Procurement Rules-2014 as prepared by the Govt. of Punjab, Punjab Procurement Regulatory Authority, shall be applicable and shall supersede any clause contained in the Bidding / Contract Documents contrary to Punjab Procurement Rules-2014.

84.1 Details to be Confidential

The Contactor shall treat the details of the Contract as private and confidential, save in so far as may be necessary for the purposed 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 Employer 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 PROVISIONS

[Project Technical Staff to include Special Provisions]

BUILDING INTERIOR WORKS FOR EXTENSION OF PIEDMC HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE

Contract # PIE/P&C/HO/25/32

BILL OF QUANTITIES (BOQ)
VOLUME-II

June 2025

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT AND MANAGEMENT COMPANY

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

Summary of Bid Schedule

A-	**Schedule Items:-**			
	1 Dismantling works		Rs=	75,928
	2 Civil works(Structure)		Rs=	2,293,024
	3 Civil Works (Finishing)		Rs=	17,585,134
	4 Furniture works		Rs=	
	5 HVAC Works		Rs=	1,338,000
	6 Public Health & Plumbing works		Rs=	1,017,193
	7 Electrical Works		Rs=	8,516,330
	8 System Works		Rs=	4,217,682
	9 Elevation works		Rs=	1,406,666
		Sub Total (A)	Rs=	**36,449,957**
B-	**Non Schedule Items:-**			
	1 Dismantling works		Rs=	
	2 Civil works(Structure)		Rs=	
	3 Civil Works (Finishing)		Rs=	
	4 Furniture works		Rs=	
	5 HVAC Works		Rs=	
	6 Public Health & Plumbing works		Rs=	
	7 Electrical Works		Rs=	
	8 System Works		Rs=	
	9 Elevation works		Rs=	
		Sub Total (B)	Rs=	

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT AND MANAGEMENT COMPANY

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

Summary of Bid Schedule

TENDER AMOUNT

C	Schedule Items Rs **36,449,957** x% Above/Below		Rs=	
D		Contingencies/Provisional Sum	Rs=	1,985,275
E		**Total (A+B+C+D)**	Rs=	
F		5% PRA on "E"	Rs=	
	Grand Total Amount(E+F) Inclusive all applicable Taxes		Rs=	

Amount in Words_____

_____

Signature & Stamp of PIEDMC_____ Signature & Stamp of Contractor_____

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

1-DISMANTLING WORKS

Sr.No.	MRS 1 st (Annual 2025)	DESCRIPTION	UNIT	Qty	RATE (Rs.)	AMOUNT (Rs.)
1	2	2	3	4.00	5.00	6 (4 x 5)
	A	SCHEDULED ITEMS				
1	4/13 / (P-31)	Dismantling brick work in lime or cement mortar.	100 Cft	823.00	6,395.40	52,634.14
2	4/20 / (P-32)	Dismantling cement concrete reinforced,separating reinforcement from concrete,cleaning and straightening the same.	100 Cft	86.00	27,086.40	23,294.30
				Sub Total (A)		75,928.45
	B	NON SCHEDULED ITEMS				
		REMOVAL OF MS WINDOWS WITH GRILLS				
1	NSI	Removal of existing Ms Windows including cost of scaffolding, Shifting at 1 point to avoid any demage Complete in all respect and conforming to the requirements of drawings, specification and to the entire satisfaction of the Architect/Engineer.				
1.1		Removal of MS Windows (7'-0"x7'-0")	Nos	20.00		
1.2		Removal of MS Ventilators (2'-0"x2'-0")	Nos	18.00		
2	NSI	Removal of MS Doors with door frame of Existing Building including cost of scaffolding and shifting at 1 point to avoid any demage. Complete in all respect and conforming to the requirements of drawings, specification and to the entire satisfaction of the Architect/Engineer.	Nos	5.00		
					Sub Total (B)	-

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY,

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

2- Civil Works (Structure)

Sr No.	MRS 1 st (Annual 2025)	DESCRIPTION	UNIT	Qty	RATE (Rs.)	AMOUNT (Rs.)
	1	2	3	4	5	6 (4×5)
	A	SCHEDULED ITEMS				
1	3/21 / (P-27)	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m) depth upto 5 ft (1.5m).				
		By Manual				
		(i) In ordinary soil	1000 Cft	778.00	15,840.00	12,324
2	10/03 / (P-64)	Supplying and filling sand under floor, or plugging in wells	100 Cft	794.00	5,427.00	43,090
3	6/05 / (P-38)	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate):				
		(b) Ratio 1: 4: 8	100 Cft	75.00	38,224.20	28,668
4	7/04 / (P-48)	Pacca brick work in foundation and plinth in:-				
		i) Cement, sand mortar:-				
		Ratio 1:6	100 Cft	113.00	40,097.80	45,311
5	7/05 / (P-49)	Pacca brick work in ground floor:-				
		i) Cement, sand mortar:-				
		Ratio 1:6	100 Cft	55.00	41,050.40	22,578
		Ratio 1:4	100 Cft	637.00	43,236.80	275,418
6	11/09 / (P-71)	Cement plaster 1:4 upto 20' (6.00 m) height:-				
		b) ½" (13 mm) thick	100 Sft	5,114.00	4,708.20	240,777
7	06/06 / (P-38+39)	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-				
7.1		(c) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and footing beams, other structural members other than those mentioned in 6(a)&(b) above not requiring form work (i.e horizontal shuttering) complete in all respects:-				
		(3) Type C (nominal mix 1: 2: 4)	Per Cft	195.84	624.00	122,204

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

2- Civil Works (Structure)

Sr No.	MRS 1 st (Annual 2025)	DESCRIPTION	UNIT	Qty	RATE (Rs.)	AMOUNT (Rs.)
	1	2	3	4	5	6 (4 x 5)
7.2		(a) Reinforced cement concrete in roof slab, beams columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-				
		(3) Type C (nominal mix 1: 2: 4)	Per Cft	658.00	771.35	507,548
8	06/13 / (P-42)	Fabrication of mild steel reinforcement for cement concrete, and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):				
		(b) Deformed bars				
		(ii) (Grade 60)	100 Kgs	2,562.00	30,321.20	776,829
9	09/05 / (P-57)	Single layer of tiles 9"x4½"x1½" (225x113x40 mm) laid over 4"(100 mm) earth and 1" (25 mm) mud plaster without Bhoosa, grouted with cement sand 1:3 on top of RCC roof slab, provided with 34 lbs. per %Sft. or 1.72 kg/Sq m bitumen coating sand blinded.				
			100 Sft	265.20	14,479.70	38,403
10	10/ 04 / (P-64)	Providing, laying, watering and ramming brick or stone ballast 1½" to 2"(40 mm to 50 mm) gauge mixed with 25% sand, for floor foundation, complete in all respects.				
			100 Cft	87.52	13,582.50	11,887
11	06/ 05 / (P-38)	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate):				
		(b) Ratio 1: 2: 4	100 Cft	66.30	50,377.80	33,400
12	12/ 17 / (P-79)	Providing and fixing 2" wide MS/ GI Chowkat singel/double rebate made of 16 SWG MS sheet pressed/welded / supported with M.S. flat 1 1/4"x1/8" i/c 6"long M.S. Flat 1"x1/8"hold fasts (6 Nos) welded/ screwed, punching of lock holecovered with MS8ox,coating with antirust paint including filling with cement sand mortar (1:8) and embedding hold fast in cement concrete (1:2:4) ,complete in all respect as approved and directed by Engineer incharge				
		(iii) 5.5 " wide	Per Sft	160.65	544.65	87,498

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

2- Civil Works (Structure)

Sr .No.	MRS 1 st (Annual 2025)	DESCRIPTION	UNIT	Qty	RATE (Rs.)	AMOUNT (Rs.)
	1	2	3	4	5	6 (4 x 5)
13	06/37 / (P-44)	Providing and laying damp proof course of cement concrete 1:2: 4(using cement, sand and shingle), including bitumen coating :-				
		b) with 2 coats of bitumen				
		i)1½" thick (40 mm)	100 Sft	39.78	12,459.10	4,956
14	09/15 / (P-58)	Khuras on roof 2'x2'x6" (600 x 600 x 150 mm	Each	1.00	1,214.65	1,215
15	09/16 / (P-58)	Bottom Khuras of brick masonry in cement mortar 1:6, 4'x2'x4½" (1200x600x113 mm) over 3" (75 mm) cemen concrete 1:4:8.	Each	1.00	2,331.70	2,332
16	01/ 01 / (P-03)	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl, kankar lime (unslaked), surkhi, etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor (Sargodha point)				
			Cft	301.76	127.88	38,588
				Sub Total (A)		2,293,024
	B	NON SCHEDULED ITEMS				
		STEEL DRILLING WITH EPOXY				
1	NSI	Providing, drilling of Steel consisting of drilling of hole, cleaning of hole and preparing of surface for epoxy filling, filling the epoxy in hole using RE-500, including cost of labour and scaffolding etc. Complete in all respect and conforming to the requirements of drawings, specification and to the entire satisfaction of the Architect/Engineer.				
		Steel #4- 100 deep	Nos	105.00		
2	NSI	Providing & injected Anti termite for Ground floor area as per instructions of the Engineer INCharge.Complete in all respects				
			Sft	11,246.00		
3	NSI	Supplying and fixing in position uPVC rain water pipe 4" dia with G.I clamps complete in all respects	Rft	10.00		
4	NSI	Supplying and fixing uPVC plain bends 4" dia rain water pipe complete in all respects	Each	1.00		
5	NSI	Supplying and fixing uPVC shoe bends 4" diafor rain water pipe complete in all respects	Each	1.00		

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

2- Civil Works (Structure)

Sr No.	MRS 1 st (Annual 2025)	DESCRIPTION	UNIT	Qty	RATE (Rs.)	AMOUNT (Rs.)
	1	2	3	4	5	6 (4 x 5)
6	NSI	Extra compensation for mortar/concrete work for using sulphate resistance cement (SRC) in place of ordinary Portland cement (OPC) below FFL/NSL and where required unit rate of SR cement bag to be quoted as difference of rate of one bag of OPC and sulphate resistance cement. (SRC)	Bags	50.00		
				Sub Total (A)		

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

3-Civil Works (Finishing)

Sr.No.	MRS 1 st (Annual 2025)	DESCRIPTION	UNIT	Qty	RATE (Rs.)	AMOUNT (Rs.)
	1	2	3	4	5	6 (4 x 5)
	A	SCHEDULED ITEMS				
1	10/46 / (P-69)	Providing and laying superb quality Porcelain glazed tiles flooring of Master/ Stile brand or approved equivalent manufacturer of specified size in approved design,Color and Shade with adhesive/bond over 3/4"thick (1:3) cement plaster i/c the cost of sealer for finishing the joints i/c cutting grinding complete in all respect as approved and directed by the Engineer Incharge.				
		a) Full body Glazed tiles				
		(iv) 600mmx 1200 mm	Per Sft	8,565.42	509.80	4,366,651.12
2	10/38 / (P-68)	Providing and laying superb quality Porcelain glazed tiles of Master Stile brand or approved equivalent manufacturer, skirting/dado of specified size, Color and Shade with adhesive/ bond over 1/2"thick (1:2) cement plaster i/c the cost of matching sealer for finishing the joints, cutting grinding complete in all respect as approved and directed by the Engineer Incharge				
		a) Full body Glazed tiles				
		(iv) 600mmx 1200 mm	Per Sft	506.00	509.95	258,034.70
3	10/24 / (P-66)	Providing and laying superb quality Ceramic tile floors of Master/ Stile brand or approved equivalent manufacturer of specified size,Glossy/Matt/Texture of approved Color and Shade as per approved design with adhesive bond, over 3/4" thick (1:2) cement sand plaster i/c the cost of sealer for finishing the joints i/c cutting grinding complete in all respects and as approved and directed by the Engineer incharge				
		i) 12"x18"/12"x24"/10"x24" /8"x24"/12"x36"	Per Sft	671.00	314.40	210,962.40
4	10/25 / (P-66)	Providing and laying superb quality Ceramic tiles dado of Master/ Stile brand or approved equivalent manufacturer of specified size,Glossy/Matt/Texture skirting/dado of approved Color and Shade with adhesive bond over 1/2"thick (1:2) cement plaster i/c the cost of sealer for finishing the joints i/c cutting grinding complete in all respects as approved and directed by the Engineer Incharge				
		i) 12"x18"/12"x24"/10"x24" /8"x24"/12"x36"	Per Sft	2,669.00	386.45	1,031,435.05
5	10/52 / (P-70)	Providing and laying Prepolished Granite of specified thickness and shade of full width of approved quality laid with adhesive bond over 3/4" thick (1:2) cement sand mortar bed , complete in all respect as approved and directed by the Engineer Incharge.				
		(i) 3/4" thick	Per Sft	382.00	1,235.40	471,922.80
		(ii) 1/2" thick	Per Sft	115.00	1,172.40	134,826.00

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

3-Civil Works (Finishing)

Sr.No.	MRS 1 st (Annual 2025)	DESCRIPTION	UNIT	Qty	RATE (Rs.)	AMOUNT (Rs.)
6	09/48 / (P-62)	Providing and fixing false ceiling comprises of Gypsum board laminated sheet of size 2'x2'/2'x3'/ 3'x3' of specified design and thickness i/c cost of fixtures i.e galvanized angle 1" x 1" at wall sides, galvanized tee 1¼" x 1" and 1 ½" x 1" both at 4' c/c (made of Taiwan CKM or equivalent), hanging with G.I/Copper wire 16 SWG, G.I hook, Rawal Plug etc. complete in all respects as approved and directed by the Engineer Incharge				
		iv) 12 mm thick	Per Sft	11,246.00	163.70	1,840,970.20
7	09/50 / (P-62)	Providing and fixing Drywall Partition (4" thick) which consist of Gypsum Board sheet screwed to G.I Track U Channel (72mm x 32mmx 32mm x 0.50mm thick) fixed at top & bottom orizontally and G.I Studs (C-Channel) size (70mm x 34mm x 36mm x 0.50mm thick) at equal vertical interval @ 2' C/C fit within the channel sections to form the frame work, including 12mm gypsum board (confirming to ASTM 1396) on both sides with infill insulation material (rockwool) i/c of jointing compound, self adhesive fiberglass tape for covering the joints between the drywall panels, corner angle bead, Smart Screws (3.5mm x 25mm), flex metal corner tape, for smooth and homogeneous look, grinding the exposed compound with abrasive paper, complete in all respects, as per specification and as approved by The Engineer	Per Sft	5,848.00	390.60	2,284,228.80
8	25/71 / (P-203)	Providing and fixing 12 mm Tempered Glass Door frameless comprising of aluminium H-section (D48) at bottom, H-type S.S framless handles both side (approved), top pivot hinges, bottom concealed floor machine hinges, s.s patch fitting, D glass door lock (approved) and all the cost of using approved standard fittings, accessories etc., and hardware any required, as shown on drawings, complete in all respect as per Specifications, as approved by the Engineer	Per Sft	391.00	2,022.70	790,875.70
9	25/57 / (P-201)	Providing and fixing aluminium glazed partition of anodized / powder coated using section of M/s. Al-Cop/ Pakistan Cable or approved equivalent manufacturer, having 2 mm thick Frame size D48-A , i/c 12 mm Tempered glass with sand blasting and edge polishing i/c the cost of tear resistance film,rubber gasket and hardware etc. complete in all respect as approved and directed by the Engineer Incharge,(Floor hinge will be paid separately)	Per Sft	1,485.00	1,642.10	2,438,518.50

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

3-Civil Works (Finishing)

Sr.No.	MRS 1 st (Annual 2025)	DESCRIPTION	UNIT	Qty	RATE (Rs.)	AMOUNT (Rs.)
10	25/52 / (P-200)	Providing and fitting all types of glazed aluminium windows of anodised/ powder coated partly fixed and partly sliding using delux sections of approved manufacturer having frame size of 100 x 30 mm (4"x1-1/4") and leaf frame sections of 50 x 20 mm (2"x¾"), all of 1.6mm 200.50 P.Sft thickness including 5 mm thick imported tinted glass with rubber gasket using approved standard latches, hardware etc., as approved by the Engineer in charge.	Per Sft	1,018.00	1,309.00	1,332,562.00
11	12/62 / (P-85)	Providing and fixing 24" Deep Box type Wardrobe consisting of 3/4" thick UV coated MDF board(Medium density Fiber board) Sheet both side glazed shutters and box comprising of 3/4" thick laminated MDF sheet i/c the cost of 1mm thick PVC tape duly hot pressed on all edges of the shutters / panels / drawers etc., with machine i/c the cost of self closing blum type hinges, handles, screws, Glue and rawal plugs, Drawers & locking arrangement complete in all respect as Approved and directed by Engineer Incharge	Per Sft	819.00	1,325.25	1,085,379.75
12	12/59 / (P-84)	Providing and fixing box type Kitchen Cabinet consisting of 3/4"thick both side Laminated MDF sheet shutter and boxes and back of 3 mm thick laminated MDF sheet i/c the cost of PVC edge binding duly hot pressed on all edges of the shutters /panels etc., with machine i/c the cost of self closing blum type hinges S.S, handles, screws, Glue and rawal plugs, locking arrangement complete in all respect as approved and directed by Engineer incharge	Per Sft	150.00	1,610.90	241,635.00
13	25/64 / (P-202)	Providing and fixing 2'-9" high stair railing comprising of non magnetic (304) Stain less steel 2" dia piperailing of 18 SWG welded with vertical posts of 2" dia stainless steel round/ Squar pipe/ Tong (Chimta) @ 2-ft c/c fixed on alternate steps with 3" long steel screws and brass rawal plugs , 3 Nos diagonal stainless steel pipes of 1/2" dia passes through gaties fixed on vertical post, i/c stainles steel welding, fixing & polishing complete in all respects as approved and directed by the Engineer Incharge.	Per Rft	83.00	3,352.70	278,274.10
14	13/31 / (P-90)	Preparing surface and painting with emulsion paint:- 3 Nos of Coats	Per Sft	18,820.00	43.51	818,858.20
				Sub Total (A)		**17,585,134.00**
	B	**NON SCHEDULED ITEMS**				
1	NSI	Providing, laying and fixing of Travertime Marble Cladding of approved brand, quality,color and laid in approved pattren including cost of filling the joints with grout & matching colour pigment, including cost of all materials, and labour, cutting. Complete in all respect and conforming to the requirements of drawings, specification and to the entire satisfaction of the Architect/Engineer.	Per Sft	407.00		

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

3-Civil Works (Finishing)

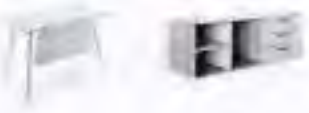
Sr.No.	MRS 1 st (Annual 2025)	DESCRIPTION	UNIT	Qty	RATE (Rs.)	AMOUNT (Rs.)
2	NSI	Providing, Fabricating and fixing of Looking mirror using 6mm thick glass by M/S Ghani Glass or approved equivalent, with back framing, including cost of baveld edges, hardware, labour etc. Complete in all respect and conforming to the requirements of drawings, specification and to the entire satisfaction of the Architect/Engineer.				
		In Toilets above Toilet Vanity's	Sft	138.00		-
3	NSI	Providing and Fixing of PVC Doors including door lock , hingies, tower rod etc complete in all respect as per drawing and specification or directed by The Engineer	Sft	368.00		
4	NSI	Providing and fixing of Frosted Film on Internal Glass Partitions & Glass Doors using Local make film. Complete in all respect and conforming to the requirements of drawings, specification and to the entire satisfaction of the Architect/Engineer.	Sft	1,491.00		-
5	NSI	Providing and fixing of Window Roll up blinds (Manual) using approved color and quality (Protector or approved equivalent), including cost of chanel, brcakets and other necessary hardware. Complete in all respect and conforming to the requirements of drawings, specification and to the entire satisfaction of the Architect/Engineer.	Sft	988.91		
6	NSI	Providing, cutting, making and fixing of Wooden Flush Doors comprising of Yellow pine Door frame (6"x2") with holdfasts for embed in walls, 1.5" thick Door Leaf will make with partal wood framing with solid cores filling, 12mm thick thick laminated sheets fixed over both sides of wooden frame (Alore / Formite), including cost of leeping (1/"x1.5") all dround the leaf of door, all necessary hardware, polish, door closer, door lock, border around door frame etc.. Complete in all respect and conforming to the requirements of drawings, specification and to the entire satisfaction of the Architect/Engineer.				
		Wooden Flush Doors	Sft	63.00		
				Sub Total (B)		

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

4-Furniture

Sr No	Specifications	Unit	Qty	Unit Price	Amount	Image's
1	**GM Desk & Side Rack Size: 83 W | 36 D | 30 H (inches)** Desk Top: Silver Apricot Veneer in Natural Finish Edging: Ash wood Vanity Panel: Silver Apricot Veneer Base: Metallic Frame with Marble Finished MFC Drawer Pedestal: 2 Distinct Handle-less drawers Cable Management: Round Pop- up Socket Glides: Rubber Glides (Note : The Furniture vender will be into board work man or any other approved by the Consultant.	Nos	2			
2	**Manager Desk & Side Rack Top Size: 63 L | 31 D | 30 H (inches)** Desk Top: Aland Pine MFC Vanity Panel: White MFC Base: Aluminum Casted Base in White Powder Coat Other Accessories: Cable Cover (Note : The Furniture vender will be into board work man or any other approved by the Consultant.	Nos	14			
3	**Assistant Manager Desk Manager Desk Top Size: 47 L | 26 D | 30 H (inches)** Desk Top: Aland Pine MFC Vanity Panel: White MFC Base: Aluminum Casted Base in White Powder Coat Other Accessories: Cable Cover (Note : The Furniture vender will be into board work man or any other approved by the Consultant.	Nos	13			
4	**Workstation/ Per person - Including Drawer Pedastel** Top Size: 47 W x 24 D (inches) (per person), 18 mm Thickness Total Size: 47 W | 24 D | 29 H (inches) Material: Aland Pine MFC Base: Aluminum Casted Metal Base with White Powder Coat (Note : The Furniture vender will be into board work man or any other approved by the Consultant.	Nos	34			

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

4-Furniture

Sr No	Specifications	Unit	Qty	Unit Price	Amount	Image's
5	**Meeting Table - 10 Person Size: 110 L | 47 D | 29 H (inches)** Table Top: Aland Pine MFC Legs: Aluminum Casted Base with white Powder Coat Finish Other Accessories: Two Stationary Trays, Vertical Spine Cable Management, & Riser (Note : The Furniture vender will be into board work man or any other approved by the Consultant	Nos	1			
6	**Meeting/Cafe Table 6 Person (Note : The Furniture vender will be into board work man or any other approved by the Consultant.**	Nos	2			
7	**Filing Cabinets Size: 39 W | 17 D | 32 H (Inches)** Size: 39 W | 17 L | 33 H (Inches) Top and Front: White MFC Carcass: Aland Pine MFC Handle: PVC (White and Grey) Shelves: 2 Glides: Rubber (Note : The Furniture vender will be into board work man or any other approved by the Consultant	Nos	10			
8	**GM Office Chair Size: 25 W | 25 D | 47 H (Inches)** Material: Mesh Back and Mesh Padded Seat Headrest: Mesh Padded Finish: Black Base: Nylon Base with Casters (Note : The Furniture vender will be into board work man or any other approved by the Consultant	Nos	11			
9	**Manager Chairs Size: 24 W | 30 D | 48 H (Inches)** Headrest: High Density High Resilience Foam Cover with Fabric Back: PP + Glass Fiber Backrest Cover with Fabric Armrest: Black PP Upholstery: Fabric (Black, Grey, (Note : The Furniture vender will be into board work man or any other approved by the Consultant	Nos	61			

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

4-Furniture

Sr No	Specifications	Unit	Qty	Unit Price	Amount	Image's
10	**Visitor Chairs** **Size: 24 W | 24 D | 39 H (Inches)** Back: PP + Glass Fiber Backrest Cover with Fabric Seat: High Density High Resilience Foam Armrest: Black PP Upholstery: Fabric (Black, Grey, Red) (Note : The Furniture vender will be into board work man or any other approved by the Consultant	Nos	45			
11	**Dining Stools** **Size: 18 W | 30 D | 43 H (Inches)** Seating Height: 32 H (Inches) Shell Structure: Plywood Upholstery: Fabric Shell Color: Smoke white Legs: Mahogany Wooden Legs with Black stain Finish Fixing Rod: Stainless-Steel Glides: Carpet (Note : The Furniture vender will be into board work man or any other approved by the Consultant	Nos	19			
12	**Dining Counter - 7 Person 10 Feet**	Nos	1			
13	**3-Seater Size: 80 W | 31 D | 30 H (Inches)** Upholstery: Velvet (Mid-Grey) Foam: Latex + Super Flex on Seat & Supreme on Back Legs: Metallic Legs Legs' Finish: Golden (Note : The Furniture vender will be into board work man or any other approved by the Consultant		3			
	Total >>	Rs				

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

5-HVAC Works

Sr.No.	MRS 1 st (Annual 2025)	Description	Qty	Unit	Rate	Amount
	A.	SCHEDULE ITEMS				
1	15/27	Supply & Installation of pre-formed tube of Elastomaric closed cell FM foam type insulation of specified thickness having density of 40-65 Kg/ m3 and thermal condcutivity of 0.035 W/M at 25 degree centigrade of fire performance conforming to UK building regulation of class - 0 rating C2, complete including the cost of adhesives and sealers as specified for chilled/ hot water piping and fittings including valves, strainers as approved and directed by Engineer Incharge.				
	a)	12mm thick				
	i)	½" dia.	50.00	Meter	238.70	11,935.00
	ii)	1" dia.	50.00	Meter	271.10	13,555.00
	iii)	1¼" dia.	20.00	Meter	319.75	6,395.00
	iv)	1½" dia.	20.00	Meter	368.40	7,368.00
2	48/23	Providing, laying, testing and commissioning u-PVC (Un plasticized Polyvinyl Chloride) Schedule4 pipe of nominal diameter, Dadex/Popular/Beta or equivalent, i/c the cost of solvent and specials complete as approved and directed by the Engineer Incharge.				
	b)	Class-E				
	iii)	1" dia.	110	Meter	494.50	54,395.00
3	57/23	Supply and Installation of Gas & Liquid Copper Piping of specified size and thickness including the cost of Fittings, Welding Complete clamps/hangers/supports,testing charges and all other related material for installation purpose complete in all respect as approved and directed by the Engineer Incharge				
	i)	¼" dia.	50	Meter	837.90	41,895.00
	ii)	⅜" dia.	20	Meter	1,265.25	25,305.00
	iii)	½" dia.	50	Meter	1,970.65	98,532.50
	iv)	⅝" dia.	20	Meter	2,639.75	52,795.00

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

5-HVAC Works

Sr.No.	MRS I st (Annual 2025)	Description	Qty	Unit	Rate	Amount
4	100/24	Providing and fixing 3" deep cable tray with straight flange fabricated with perforated G.I. Sheet of specified guage,size and depth duly wall supported/ceiling hung,supported on painted brackets of MS angle iron of 1- 1/2"x1 1/2"x3/16" and MS patti of 1-1/2"x3/16" size @ 5 ft C/C, hangers i/c the cost of hardwares as approved and directed by the Engineer Incharge.				
		16-SWG				
	b)	3" deep				
	ii)	6"x3".	150	Meter	2,118.70	317,805.00
5	102/24	Providing and fixing 4" deep cable tray with straight flange fabricated with perforated G.I. Sheet of specified guage,size and depth duly supported on painted brackets of MS angle iron of 1-1/2"x1-1/2"x3/16" and MS patti of 1- 1/2"x3/16" size @ 3 ft C/C, hangers i/c the cost of hardwares as approved and directed by the Engineer Incharge.				
		14-SWG				
	i)	12"x4".	80	Meter	5,017.55	401,404.00
	iii)	16"x4".	25	Meter	5,712.10	142,802.50
6	103/24	Providing and fixing screwless cable tray cover fabricated with 18 SWG G.I. Sheet of required size i/c the cost of hardware as approved and directed by the Engineer Incharge.				
	iii)	6" wide.	150	Meter	480.00	72,000.00
	vi)	12" wide.	80	Meter	824.40	65,952.00
	vii)	16" wide.	25	Meter	1,034.50	25,862.50
				Total Rs:-		**1,338,000.00**

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

5-HVAC Works

Sr. No.	Description	Qty	Unit	Rate	Amount
B.	**NON SCHEDULE ITEMS**				
1	SPLIT AIR-CONDITIONER AND ANGLE IRON FRAME				
1.01	Supply, Installation, Testing and Commissioning of Split Wall mounted type **Inverter** A/C unit **make Haier** or approved equivalent including indoor evaporation & outdoor condensing unit (cooling/heating) operated at 230V, 50 Hz, 1 phase including control wiring as required with following size, complete in all respects.				
i)	1 TR wall mounted type A/C unit.	12	Each		
ii)	1.5 TR wall mounted type A/C unit.	11	Each		
iii)	2.0 TR wall mounted type A/C unit.	8	Each		
1.02	Supply & Installation of angle iron frame with antirust enamel of 2 coats & final grey paint, for split A/C outdoor units including antivibration pads, to be fixed on exterior wall, as per approval of Consultant (for 1.0 ton, 1.5 ton, 2.0 and 2.5 ton).	31	Nos.		
		SUB TOTAL SECTION (1.0)			

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

6-PUBLIC HEALTH WORKS

Sr.No.	MRS 1 st (Annual 2025)	DESCRIPTION	UNIT	QUANTITY	RATE (Rs.)	AMOUNT (Rs.)
1	2	2	3	4	5	6 (4 x 5)
	A	SCHEDULED ITEMS				
		SANITARY WORKS				
1	19/ 07 / (P-115)	Providing and fitting glazed earthen ware wash hand basin /vanity 56x40 cm (22"x16") including bracket set, waste pipe and waste coupling, etc.				
		ii) coloured, with pedesta	Each	1.00	10,680.75	10,680.75
		v) Under Counter Vanity Basin	Each	7.00	11,880.75	83,165.25
2	19/ 03 / (P-115)	Providing and fitting one piece European Coupled set of Water Closet (WC) and flushing Cistern of PORTA brand (full size) or approved equivalent manufacturer i/c the cost of CP/rubber connection, thimble, normal seat over and rawal bolts complete in all respects as pproved and directed by the Engineer Incharge.	Each	7.00	58,465.50	409,258.50
3	19/ 52 / (P-120)	Providing and fixing CP bath Room Set made of Sonex/Master/Faisal or approved equvilent manufacturer, comprising of 3-No Tee stop cocks, lever type Basin Mixer, double Bib Cock, open wall shower, Muslim shower,waste coupling and bottle trap etc. complete in all respect as approved and directed by the Engineer incharge				
		(i) 3 No Tee Stop Cock (set)				
		(ii) Lever Type Basin Mixer	Each	7.00	6,672.30	46,706.10
		(iii) Double Bib Cock	Each	7.00	1,872.30	13,106.10
		(iv) Open Type Wall Shower				
		(v) Muslim shower	Each	7.00	2,352.30	16,466.10
		(vi) Waste Coupling				
		(vii) Bottle Trap	Each	7.00	2,352.30	16,466.10
4	19/ 18 / (P-116)	Providing and fixing, chromium plated toilet paper holder.	Each	7.00	1,202.10	8,414.70
5	19/ 16 / (P-116)	Providing and fixing, chromium plated soap dish	Each	7.00	937.75	6,564.25
		WATER SUPPLY WORKS				

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

6-PUBLIC HEALTH WORKS

Sr.No.	MRS 1 st (Annual 2025)	DESCRIPTION	UNIT	QUANTITY	RATE (Rs.)	AMOUNT (Rs.)
1	2	2	3	4	5	6 (4 x 5)
6	23/ 47 / (P-149)	Providing, laying, testing and commissioning of POLYPROPYLENE RANDOM COPOLYMER (PPRC) water supply pipe (Dadex /Popular/ Beta or approved equivalent manufacturer, with specified pressure rating PN (PRESSURE NOMINAL)and conforming to DIN 8077-8078 code i/c cost of solvent, specials,making jharries completein all respect asapproved and directed by Engineer Incharge.(Internal/External Diameters mentioned).				
		b) PN-20 pipe				
		(ii) 25 mm	Per Rft	120.00	101.15	12,138.00
		(iii) 32 mm	Per Rft	96.00	161.30	15,484.80
		(iv) 40 mm	Per Rft	7.80	246.65	1,923.87
		(v) 50 mm	Per Rft	46.80	354.85	16,606.98
		(vi) 63 mm	Per Rft	31.20	554.50	17,300.40
7	23/ 52 / (P-152)	Providing and fixing heavy duty Gate valve of specified diameter and material for pressure rating PN-16 mde of Crane (USA), Hatersly (UK), Scon (Pakistan) or approved equivalent manufacturer, i/c the cost of all accessories flanges,nut/bolt and gaskit where required complete in all respect as approved and directed by the Engineer Incharge				
		(a) Brass Threaded Valves				
		(ii) 3/4" dia	Each	1.00	3,680.40	3,680.40
		(iii) 1" dia	Each	1.00	5,005.45	5,005.45
		(vi) 2" dia	Each	1.00	14,844.60	14,844.60
8	19/ 51 / (P-120)	Providing and hoisting vertical/ horizontal type storage tank of required capacity made of rotationally molded from (HDPE), double ply polyethelene of approved manufacturer i/c cost of making connection for inlet/outlet pipe, float valve i/c all cost of specials& labour complete in all respect as approved and directed by the Engineer Incharge	Per Gall	1,000.00	117.45	117,450.00
		DRAINAGE WORKS				

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

6-PUBLIC HEALTH WORKS

Sr.No.	MRS 1 st (Annual 2025)	DESCRIPTION	UNIT	QUANTITY	RATE (Rs.)	AMOUNT (Rs.)
1	2	2	3	4	5	6 (4 x 5)
9	23/ 27 / (P-141)	Providing, laying, cutting, jointing, testing and disinfecting Chap Providing and installing specials pipe line in trenches with PVC/ uPVC pipes of B.S.S. with 'D' 2 and valves is not included in the Class working pressure complete in all respects:-				
		a) 2" i/d (50 mm)	Per Rft	31.20	245.90	7,672.08
		b) 3" i/d (75 mm)	Per Rft	46.80	529.05	24,759.54
		c) 4" i/d (100 mm)	Per Rft	120.00	882.80	105,936.00
10	21/ 07 / (P-128)	Constructing gully grating chamber, 12"x12", (300x300 mm) complete in all respects.				
		a) with C.I. gully trap, weighing 81 lbs. (36.75 Kg.) frame hinged safety type.	Each	1.00	17,234.35	17,234.35
11	19/ 49 / (P-120)	Providing, fixing, testing and commissioning of µ-PVC (Unplasticized polyvinyl Chloride) Nikasi/ waste pipe Fittings make of Dadex /Popular/Beta or approved equivalent manufacturer, conforming to BS 4514 / BS 5255 including the cost of Solvents complete in all respect as approved and directed by the Engineer Incharge				
		P-Trap				
		(i) 4" dia	Each	10.00	1,141.80	11,418.00
12	19/ 8 / (P-115)	Providing and fixing stainless steel sink with drain board, size 120x60 cm (48"x24") including bracket set, waste pipe and waste coupling	Each	1.00	4,145.15	4,145.15
13	19/ 30 / (P-117)	Providing and fixing, chromium plated mixing valve, for wash hand basin, sink or shower.	Each	8.00	3,845.75	30,766.00
				Sub Total (A)		1,017,193.00
	B	NON SCHEDULED ITEMS				-

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

7-Electrical Works

Sr. No.	MRS 1 st (Annual 2025)	Description	Qty	Unit	Rate	Amount
A.		**SCHEDULE ITEMS**				
A		**PIPES AND WIRING CABLES**				
	4/24	Supply and erection of PVC pipe for wiring on surface including clamps inspection boxes, pull boxes, bends, tees, repairing surface, etc., complete with all specials:-				
	ii)	20 mm i/d.	792	Meter	227.35	180,061
	iii)	25mm i/d.	357	Meter	285.30	101,852
	3/24	Supply and erection of PVC pipe for wiring recessed in walls, including inspection boxes, pull boxes, hooks, cutting jharries, and repairing surface, etc, complete with all specials.				
	ii)	20mm i/d.	217	Meter	375.05	81,386
	iii)	25mm i/d.	931	Meter	445.80	415,040
	v)	40mm i/d.	40	Meter	621.05	24,842
	vi)	50mm i/d.	40	Meter	768.40	30,736
	6/24	Supply and erection PVC pipe for recessed wiring (main and sub-main) purpose, including bends, specials, etc. in floor, wall or trenches:-				
	ii	50mm i/d.	30	Meter	779.50	23,385
	iii)	100mm i/d	145	Meter	1,252.50	181,613
	11/24	Supply and erection of single core PVC insulated copper conductor cables, in prelaid PVC pipe/M.S. conduit/G.I. pipe/wooden strip batten/wooden casing an capping/G.I.wire/trenches (rate for cables only):-				
	a)	**250/440 volts, PVC insulated.**				
	i)	3/0.74mm (3/0.029").	4120	Meter	117.75	485,130
	iii)	7/0.74mm (7/0.029").	1008	Meter	185.35	186,833
	iv)	7/0.91mm (7/0.036").	5440	Meter	245.80	1,337,152
	v)	7/1.12mm (7/0.044").	380	Meter	361.80	137,484
		SUB TOTAL SECTION (A)				***3,185,510***
B		**POWER CABLES**				
	c)	**450/750 volts, PVC insulated:**				
	vi)	10 mm sq (7/0.052")	212	Meter	577.90	122,515
	vii)	16 mm sq (7/0.064")	160	Meter	872.80	139,648
	xi)	70 mm sq (19/0.083")	165	Meter	2,973.00	490,545

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

7-Electrical Works

Sr. No.	MRS 1 st (Annual 2025)	Description	Qty	Unit	Rate	Amount
	14/24	Supply and erection of PVC insulated, PVC sheathed copper conductor cables for service connection, in prelaid pipe/G.I. wire/trenches, etc. (rate for cable only):-				
	c)	**Four core, 600/1000 volt non armoured cable:-**				
	vi)	10 mm (7/0.052")	212	Meter	1,981.75	420,131
	vii)	16 mm (7/0.064")	30	Meter	3,031.90	90,957
	viii)	25 mm (19/0.052")	85	Meter	4,670.15	396,963
	xiii)	120 mm sq.(37/0.083")	29	Meter	20,769.70	602,321
		SUB TOTAL SECTION (B)				***2,263,080***
C		***LT-PANELS,DISTRIBUTION BOARDS AND BREAKERS***				
	93/24	P/F wall mounted DB (Distribution Board) made with 16SWG Sheet (Recessded/Surface mounted Type), Powder coated Paint, i/c the cost of Lock, Indication lights,Thimble, Copper Comb, Wiring, Netural & Earth Bar, Door Earthing, Digital Voltmeter, Digital Ammeter,Volt Selector Switch, Ammeter selector switch, Current Transformers and Controles Complete in all respect as approved and directed by the Engineer incharge (Breakers will be Paid Separately)				
	a)	**6" deep.**				
	i)	20-60A.	8	P.Cft	24,466.65	195,733
	ii)	75-100A.	5.5	P.Cft	18,791.25	103,352
	88/24	Suppling,Installation and comissioning of MCB (Miniature Circuit Breaker) of specified rating made of LEGRAND FRANCE/ GE U.S.A / SCHNEIDER GERMANY /SIEMEN GERMAN/ TERASAKI JAPAN/ ABB-SWITZERLAND in prelaid DBs and Panels i/c the cost of screwes,necessary wire complete in all respect as approved and directed by the Engineer Incharge.				
	a)	**Single Pole**				
	ii)	6-40 Amp (6KA)	165	Each	1,128.85	186,260

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BILL OF QUANTITIES (GF)

7-Electrical Works

Sr. No.	MRS 1 st (Annual 2025)	Description	Qty	Unit	Rate	Amount
	89/24	Supplying, Installation and commissioning of MCCB (Moulded Case Circuit Breaker) of specified rating **made of LEGRAND FRANCE/ GE U.S.A / SCHNEIDER GERMANY / TERASAKI JAPAN/ SIEMEN/ ABB SWITZERLAND (with fixed Thermal-Magnetic Trip) in prelaid DBs and Panels i/c the cost of screws, necessary wire complete in all respect as approved and directed by the Engineer Incharge.**				
	a)	**Tripple Pole**				
	ii)	15-100Amp (10KA, 15KA)	5	Each	13,798.25	68,991
	v)	15-100Amp (25KA)	14	Each	19,760.75	276,651
	x)	300-630Amp (36KA)	3	Each	93,377.85	280,134
	b)	**Four Pole**				
	v)	15-200Amp (36KA)	1	Each	36,085.45	36,085
	xi)	225-630Amp (36KA)	3	Each	115,883.95	347,652
	94/24	P/F floor mounted Electric Panel board of required depth and size, fabricated with 14SWG M.S sheet (Indoor/Outdoor Type),derusting, zinc Phosphated, finish with electro static powder coating in approved colour i/c the cost of capacitor trip unit over current, Lock, Indication lights, Brass glands, Netural & Earth bar, Digital volt meter/ Amp meter, Slector switchs, Current Transformers, Controles, Channels, Copper bus bars of specified capacity ,Door Earthing, complete in all respects as approved and directed by the Engineer Incharge (Breakers will be Paid Separately).				
	1)	LT-Switchboards				
	a)	2.5 ft deep				
	i)	250-600A	142	P.Cft	4,348.25	617,452
		SUB TOTAL SECTION (C)				***2,112,310***
D		***SWITCHES, SOCKETS AND BACK BOXES***				

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EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

7-Electrical Works

Sr. No.	MRS 1 st (Annual 2025)	Description	Qty	Unit	Rate	Amount
	108/24	P/F PVC double layer Switch kit Face plate with specified switch holes i/c the cost of switches / sockets / dimmer made of Legrand/ABB/Schenider or approved equivalent manufacturer screws complete as approved and directed by the Engineer incharge.				
	a)	**One way Gange Switch**				
		Small				
	i)	01 Gange.	1	Each	453.30	453
	ii)	02 Gange.	7	Each	694.50	4,862
	iii)	03 Gange	15	Each	878.10	13,172
	iv)	Three pin light plug 10/13Amp	246	Each	744.55	183,159
	viii)	Three pin power plug 15-32Amp.	15	Each	914.65	13,720
	v)	Telephone/TV/data cable socket.	1	Each	657.55	658
		Large				
	i)	04 Gange.	5	Each	971.35	4,857
	ii)	05 Gange.	5	Each	1,141.45	5,707
	iii)	06 Gange.	4	Each	1,395.95	5,584
	109/24	Supply, installation, testing & commissioning of 16 SWG Sheet Steel powder coated back Boxes with earth terminal, recessed in wall, including accessories, , complete in all respect as per specifications and as approved by Engineer Incharge.				
	i)	Small 3"x3".	86	Each	555.70	47,790
	ii)	Large 6"x3"	14	Each	697.30	9,762
		SUB TOTAL SECTION (D)				***289,720***
	E	***BRACKET/EXHAUST FANS***				
	105/24	Providing and fixing Pakistan Energy Label NEECA approved Copper winded Exaust Fan i/c the cost of necessary cable and hardware for connection from ceiling rose complete as approved and directed by Engineer Incharge.				
	a)	**Plastic body**				
	ii)	12" dia.	2	Each	6,048.10	12,096
	106/24	Providing and fixing Pakistan Energy Label NEECA approved Copper winded wall bracket Fan i/c the cost of necessary cable and hardware for connection as approved and directed by Engineer Incharge.				

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

7-Electrical Works

Sr. No.	MRS 1 st (Annual 2025)	Description	Qty	Unit	Rate	Amount
	ii)	24" sweep dia.	35	Each	11,400.10	399,004
		SUB TOTAL SECTION (E)				***411,100***
F		***CABLE TRAY AND COVER***				
	100/24	Providing and fixing specified deep cable tray with straight flange fabricated with perforated G.I. Sheet of specified guage,size and depth duly wall supported/ceiling hung on painted brackets of MS angle iron of 1"x1"x1/8" and MS patti of 1-1/2"x3/16" size @ 5 ft C/C, hangers i/c the cost of hardwares as approved and directed by the Engineer incharge.				
	b)	**3" deep**				
	iv)	10"x3"	80	Meter	2,457.10	196,568
	103/24	Providing and fixing screwless cable tray cover fabricated with 18 SWG G.I. Sheet of required size i/c the cost of hardware as approved and directed by the Engineer Incharge.				
	v)	10" wide	80	Meter	725.55	58,044
		SUB TOTAL SECTION (F)				***254,610***
					Total Rs:-	***8,516,330***

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

7-Electrical Works

Sr. No.	Description	Qty	Unit	Rate	Amount
B.	***NON SCHEDULE ITEMS***				
1.0	***FLOOR BOX/TECHNOLOGY BOXES, DURA DUCT AND CABLE CATCH PIT***				
1.01	Supply and installation of adjustable 12 SWG die cast aluminum 12"x12"x4" **floor boxes** having base box of 16-SWG G.I. sheet **make see Annexure"A"** with 3 sets of 15A PVC connectors, including floor cutting as required as per drawings for following outlets and space of following outlets (excluding cost of socket/outlet).				
i)	1-Voice outlet.				
ii)	1-Data outlet.				
iii)	1-3 pin 13A international switch socket outlet (Wapda Tagging).				
iv)	2-3 pin 13A international switch socket outlets (UPS Tagging).	33	Each		
1.02	Supply and installation of adjustable 18- SWG sheet steel with electrostatic painted **technology box** size 20"x4"x2½" **make see Annexure"A"** including wall cutting as required as per drawing and space of following outlets (excluding cost of socket/outlet).				
i)	1-Data outlet.				
ii)	1-Telephone outlet.				
iii)	1-3 Pin 13 Amp international switch socket outlet (Wapda Tagging).				
iv)	2-3 Pin 13 Amp international switch socket outlets (UPS Tagging).	34	Each		
1.03	Supply & installation of following sizes PVC dura duct **make see Annexure"A"** to be installed on work station including all installation accessories, complete in all respects.				
i)	25mmx25mm.	35	Meter		
1.04	Supply and Construction of following size internal size cable catch pits (CCP) including earth work 4" thick P.C.C 9" thick first class burnt brick work, in 1:5 cement sand mortar plaster inside in 1:5 cement sand, and 4" thick P.C.C slab with 12" dia C.I. manhole cover to BS 497 double rubber seal material conforming to BS 1452 grade 150 including 4" dia perforated PVC pipe of 4 meter length vertically installed after making a bore hole under manhole, complete in all respects as per details shown in drawing.				
i)	2'x2'x3'	3	Each		
			SUB TOTAL SECTION (2.0)		

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

7-Electrical Works

Sr. No.	Description	Qty	Unit	Rate	Amount
B.	***NON SCHEDULE ITEMS***				
2.0	***LIGHTING FIXTURES***				
2.01	Supply and Installation of LED/SMD light fittings.The light fitting **make see Annexure"A"**. All the light fixture have the efficacy of 100 lumens/Watt & have 3 yrs of standard replacement warranty. The power factor of the light fitting should >0.9 & have <15% THD. The color shifting of the LED Source should not be greater than 5 SDCM for indoor light. The LED should be atleast 100 lumens/Watt.				
i)	2ft x 2ft LED Light light (36-38Watt) including all accessories.	150	Each		
ii)	Ceiling recessed 12-13Watt SMD downlighter.	16	Each		
iii)	Surface mounted 2 feet long SMD light (9Watt).	8	Each		
iv)	Flood Light 50Watt	8	Each		
	SUB TOTAL SECTION (3.0)				
3.0	***POWER CABLES***				
3.01	Supply, Laying & Connecting up of 600/1000 volt grade single /4 core PVC insulated and PVC sheathed **Aluminium conductor** cables as				
	specified **make see Annexure"A"** of following size **including bimetallic thimble and heat shrinkable colour sleeves.**				
	Note:- Cables shall be purchased as per actual measurements at site.				
i)	Single core 185mm2 PVC/PVC Alu. conductor cable.	37	Meter		
ii)	4 core 150mm2 PVC/PVC Alu. conductor cable.	138	Meter		
	SUB TOTAL SECTION (4.0)				
4.0	***EARTHING SYSTEM***				
4.01	Supply and installation of **1½" dia & 10 ft long 16-SWG tin plated copper pipe filled with primary earth chemical to be lowered in 30 feet deep 4" dia bore hole, complete with clamps from bottom and top of pipe rod to ground surface earth connecting point the pipe & bore hole to be filled with secondary earth chemical model GEM-25A of ERICO, complete with 1x70mm2 stranded copper conductor** from earth pipe to ground surface in 1½" dia PVC pipe with breather hole (length 5 feet only) with watering cap, earth access hole comprising of 12"x12" and 12" deep 16-SWG M.S. sheet steel with 12-SWG M.S. cover, both hot dipped galvanized, as per detail shown in drawings.				
i)	Transformer neutral.	1	Each		
ii)	Transformer body and main switch.	1	Each		
iii)	MPB and ATS with MOR panel.	2	Each		

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR

BILL OF QUANTITIES (GF)

7-Electrical Works

Sr. No.	Description	Qty	Unit	Rate	Amount
B.	***NON SCHEDULE ITEMS***				
4.02	Supply and installation of **1¾" dia & 10 ft long 16-SWG tin plated copper pipe filled with primary earth chemical to be lowered in 30 feet deep 4" dia bore hole, complete with clamps from bottom and top of pipe rod to ground surface earth connecting point the pipe & bore hole to be filled with secondary earth chemical model GEM-25A of ERICO, complete with 1x16mm2 stranded copper conductor** from earth pipe to ground surface in 1½" dia PVC pipe with breather hole (length 5 feet only) with watering cap, earth access hole comprising of 12"x12" and 12" deep 16-SWG M.S. sheet steel with 12-SWG M.S. cover, both hot dipped galvanized, as per detail shown in drawings.				
i)	Main Data Cabinet.	1	Each		
	SUB TOTAL SECTION (5.0)				
5.0	***STANDBY POWER SUPPLY SYSTEM***				
5.01	***DIESEL GENERATORS SET WITH CANOPY***				
	Supply, loading, unloading, installation, Connecting, Load Testing, and commissioning of 100kVA Prime Diesel Generator Set along with Sound and weather Proof Canopy with noise level of 85 dB at 1 meter, fuel tank minimum 160 liter fuel capacity, AMF module deep sea, 200Amp MCCB adjustable, battery charger deepsea, complete in all respect and as per attached specifications, complete in all respects and as per specifications.	1	Each		
	Supply, installation, testing & commissioning of ATS Panel with MOR for 100kVA Generator having 200Amp Adj MCCB Breakers and 200Amp Magnetic Contators , including all accessories, complete in all respect as per specifications and as approved by Engineer incharge.	1	Each		

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

7-Electrical Works

Sr. No.	Description	Qty	Unit	Rate	Amount
B.	NON SCHEDULE ITEMS				
5.02	Supply and installation of **1¼" dia & 10 ft long 16-SWG tin plated copper pipe filled with primary earth chemical to be lowered in 30 feet deep 4" dia bore hole, complete with clamps from bottom and top of pipe rod to ground surface earth connecting point the pipe & bore hole to be filled with secondary earth chemical model GEM-25A of ERICO, complete with 1x70mm2 stranded copper conductor** from earth pipe to ground surface in 1½" dia PVC pipe with breather hole (length 5 feet only) with watering cap, earth access hole comprising of 12"x12" and 12" deep 16-SWG M.S. sheet steel with 12-SWG M.S. cover, both hot dipped galvanized, as per detail shown in drawings.				
i)	Generator neutral	1	Each		
ii)	Generator body	1	Each		
	SUB TOTAL SECTION (6.0)				
				Total Rs:-	

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

8-Electrical System Works

Sr. No.	Description	Qty	Unit	Rate	Amount
A.	**SCHEDULE ITEMS**				
A	**DATA AND VOICE SYSTEM**				
4/24	Supply and erection of PVC pipe for wiring on surface including clamps inspection boxes, pull boxes, bends, tees, repairing surface, etc. complete with all specials:-				
iii)	25mm i/d.	330	Meter	285.30	94,149.00
3/24	Supply and erection of PVC pipe for wiring recessed in walls, including inspection boxes, pull boxes, hooks, cutting jharnes, and repairing surface, etc. complete with all specials.				
iii)	25mm i/d.	630	Meter	445.80	280,854.00
6/24	Supply and erection PVC pipe for recessed wiring (main and sub-main) purpose, including bends, specials, etc. in floor, wall or trenches:-				
i)	50mm i/d.	60	Meter	779.50	46,770.00
100/24	Providing and fixing specified deep cable tray with straight flange fabricated with perforated G.I Sheet of specified guage,size and depth duly wall supported/ceiling hung on painted brackets of MS angle iron of 1"x1"x1/8" and MS patti of 1-1/2"x3/16" size @ 5 ft C/C, hangers i/c the cost of hardwares as approved and directed by the Engineer Incharge				
b)	**3" deep**				
ii)	6"x 3"	28	Meter	2,118.70	59,323.60
iii)	8"x 3"	34	Meter	2,255.65	76,692.10
103/24	Providing and fixing screwless cable tray cover fabricated with 18 SWG G.I. Sheet of required size i/c the cost of hardware as approved and directed by the Engineer Incharge.				
iii)	6" wide.	28	Meter	480.00	13,440.00

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

B-Electrical System Works

Sr. No.	Description	Qty	Unit	Rate	Amount
A.	**SCHEDULE ITEMS**				
iv)	8" wide	34	Meter	585.05	19,891.70
113/24	Supply, Installation and commissioning of wiring with 4-pair data Cable, 23 AWG UL/EN listed cable * Conforming to following standards TIA/EIA 568 / ISO/IEC 11801, in prelaid conduit / cable tray from including all accessories, Manufacturer/OEM Authorization, Make: Schneider / i-connect UK/3M Corning USA/ D-Link/ Pollo Australian or equivalent complete in all respect as approved and directed by Engineer Incharge.				
a)	**UTP (Unshielded Twisted pair)**				
i)	CAT-6 (Min 1G @ 250MHz or higher)	4060	Per Meter	160.20	650,412.00
119/24	Supply, Installation and Connection of Data switch, 10/100/1000 Mbps with SFP UPLINK made of Cisco USA/NOVAS Europe/Juniper USA / Huawei/H3C Pollo Australian or equivalent approved manufacturer and directed by the Engineer Incharge.				
iv)	24 Ports	3	Each	3,568.40	10,705.20
121/24	Supply and installation of Cable Metal Organizer, 19" Rack mounted with high graded epoxy powder coating and slideable top- UL Listed. Made of Schneider/i-Connect UK/3M Corning; Pollo Australia or equivalent approved manufacturer and directed by the Engineer Incharge	3	Each	4,029.60	12,088.80

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

8-Electrical System Works

Sr. No.	Description	Qty	Unit	Rate	Amount
A.	SCHEDULE ITEMS				
122/24	Supply, Installation and commissioning of 19" Rack Mounted of specified, UTP Patch Panel with specified toolless support & Rear Cable Management, UL listed, Loaded with UTP of specified Keystone Jack Toolless Support . Made of Schneider / Norden /3M Corning/D-Link, Pollo Australia or equivalent approved manufacturer and Directed by Engineer Incharge.				
i)	CAT-6 (24 Port Patch Panel with Toolless Support 1-Gigabit).	3	Each	31,931.05	95,793.15
136/24	Supply , installation of wall mounted CCTV Cabinet comprising of Powder Coated M.S frame, front glass & two side openings, 02 way fans for cooling, top & bottom entry, handle lock with 6 way PDU (Power Distribution Unit) with all necessary accessories/ materials, complete in all respects. Made of Bosch/ HP / Dell , Pollo Australia or equivalent or as approved and directed by Engineer Incharge				
ii)	15U size (600x550x770 mm)	1	Each	59,747.30	59,747.30
138/24	Supply, Installation and commissioning of Simple type, Dual Shutter Face Plates having fully populated I/O:				
	Option 1: RJ-11 with RJ45/8P8C I/Os supporting either Cat6 or Cat6a cables as required by project.				
	Option 2: Two RJ45/8P8C I/Os supporting either Cat6 or Cat6a cables as required by project.				
i)	Single I/O.	108	Each	1,783.20	192,585.60

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

8-Electrical System Works

Sr. No.	Description	Qty	Unit	Rate	Amount
A.	**SCHEDULE ITEMS**				
144/24	Supply, Installation of WiFi access points(APs),conforming IEEE as approved and directed by the Engineer Incharge.				
i)	**Support upto 50 concurrent connections.**				
a)	Data transfer rate Min 802.11ac: 1200 Mbps.				
b)	Support upto 50 concurrent connections.				
c)	4X4 MIMO support (3SU,3MU)				
d)	2xEthernet 10/100/1000 Base-T (RJ-45)				
e)	1x100/1000 BASE -X (SFP) optionally				
f)	N- Type (Female) for external antennas (Omni,sector rod,etc.).				
g)	IEEEa/b/g/n/ac wave 2 standards, should work on 2.4 & 5.8 Ghz band Simultaneously ans @ 2.4 Ghz support 500 Mbps				
h)	VLAN 802.1Xauthentication ,NAT and DHCP client,LLDP,ACL Ipv4 and Ipv 6 support.				
i)	Power supply: PoE + 48 V /54 V (IEEE 802.3 at -2009) 48 V DC.				
j)	Operating Temperature from -10 to +45 C. managed by wireless controller. Make: - Aruba / Cisco / Al-Catel as approved and directed by Engineer Incharge,Support Automatic RF channel selection, and dual stack. Make: - Aruba /Cisco/Al-Catel.	3	Each	93,844.80	281,534.40

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

8-Electrical System Works

Sr. No.	Description	Qty	Unit	Rate	Amount
A.	**SCHEDULE ITEMS**				
116/24	Supply, Installation and commissioning of Cat-6, UTP Machine Made Patch Cord of Specified Length, Support 10 Giga, UL listed cable, with anti snag boots, Gold Over Nickel Plated, Manufacturer/OEM Authorization confirming to manufacturer warranty, Made of Schneider / i-Connect UK /Panduit USA/D- Link/3M, Corning ,Pollo Australian or equivalent Approved and Directed by Engineer Incharge.				
i)	1 Meter Patch Cord	67	Each	1,067.80	71,542.60
ii)	3 Meter Patch Cord	67	Each	1,303.00	87,301.00
141/24	Supply, Installation and commissioning of Armored Fiber Optic Cable of specified core and mode, Fiber Optic Connection, UL listed , in prelaid/pipe, cable tray , including all accessories, made of Norden / Schneider/Panduit/ Pollo Australia or equivalent Complete in all respect as approved and directed by Engineer Incharge.				
a)	Multimode OM3				
i)	04 core	75	Meter	1,287.05	96,528.75
	SUB TOTAL SECTION (A)				**2,149,359.20**
B	**IP-CCTV SYSTEM**				
4/24	Supply and erection of PVC pipe for wiring on surface including clamps inspection boxes, pull boxes bends, tees, repairing surface, etc., complete with all specials:-				
iii)	25mm i/d	245	Meter	285.30	69,898.50

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

8-Electrical System Works

Sr. No.	Description	Qty	Unit	Rate	Amount
A.	***SCHEDULE ITEMS***				
113/24	Supply, Installation and commissioning of wiring with 4-pair data Cable 23 AWG UL/EN listed cable * Conforming to following standards: TIA/EIA 568 / ISO/IEC 11801, in prelaid conduit / cable tray from including all accessories, Manufacturer/OEM Authorization, Make: Schneider / i-connect UK/3M Corning USA/ D-Link/ Pollo Australian or equivalent complete in all respect as approved and directed by Engineer Incharge.				
a)	**UTP (Unshielded Twisted pair)**				
i)	CAT-6 (Min 1G @ 250MHz or higher).	720	Per Meter	160.20	115,344.00
129/24	Supply, installation & connecting IP based Camera of specified resolution, 1/3" Progressive scan, fixed lens 2.8 mm AF, Max resolution 2592 x 1920mm, Codec H-265, Camera with 25 fps, day night (ICR), ONVIF, IP-66, Max IR distance 30 meter WDR Smart Analytics, i/c the cost of mounting bracket, mounting accessories/ materials, Make: - Honey Well/Bosch/ Norden, Pollo Australia or equivalent, as approved as directed by the Engineer Incharge.				
(b)	**4 Mega Pixel**				
i)	Fixed Bullet Type.	18	Each	76,210.50	1,371,789.00
	SUB TOTAL SECTION (B)				***1,557,031.50***
C	***FIRE ALARM SYSTEM***				
4/24	Supply and erection of PVC pipe for wiring on surface including clamps inspection boxes, pull boxes, bends, lees, repairing surface, etc., complete with all specials:-				
iii)	25mm i/d.	260	Meter	285.30	74,178.00

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

8-Electrical System Works

Sr. No.	Description	Qty	Unit	Rate	Amount
A.	**SCHEDULE ITEMS**				
3/24	Supply and erection of PVC pipe for wiring recessed in walls including inspection boxes, pull boxes, hooks, cutting jharries and repairing surface, etc, complete with all specials.				
iii)	25mm i/d.	15	Meter	445.80	6,687.00
165/24	Supply, Installation and commissioning of wiring with specified Fire Resistant Shielded Cable (Fire Rating for 2 hours) of required size from respective DB to Fire Alarm FACP (Fire Alarm Controle Panel) in prelaid conduit/duct. Make Pony/Belden/Covican (Italy) or equilvent as approve and directed by the Engineer Incharge				
i)	2C, 1.5mm sq.	310	Meter	427.50	132,525.00
166/24	Supply, Installation and commissioning with Addressable Break Glass unit, (Manual Call Point) with key type EN-54 having a built in short circuit isolator and microprocessor to ensure a response time of max. 1 second,having an indication LED flash after pressing the button to acknowledge the activation and a key operation facility for testing purposes. made of Honeywell/ Bosch/ Eaton (UK) or as approved and directed by the Engineer Incharge.	2	Each	18,586.90	37,173.80

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

8-Electrical System Works

Sr. No.	Description	Qty	Unit	Rate	Amount
A.	SCHEDULE ITEMS				
167/24	Supply, installation and commissioning of Addressable Type Indoor Loop Powered electronic Sounder/Flasher/ Bell EN-54 with minimum sound output 100dB at 1 meter with frequencies of variety of sounds as required and shall be loop wired and loop signaled, built in short circuit isolator, configured via software. made of Honeywell/ Bosch/ Eaton (UK), as approved and directed by the Engineer Incharge.				
ii)	With flasher.	2	Each	25,923.00	51,846.00
168/24	Supply, installation and commissioning of Addressable Optical Smoke Detectors EN-54, incorporating an LED indication located in labyrinth with in thehousing of thedetector Sensing unit, adjustableviasoftwarebetween 0- 90 seconds having built in short circuit				
	isolators on both inputs, make Honeywell/ Bosch/ Eaton (UK), including the cost of all other accessories as required, approved and directed by the Engineer Incharge.				
i)	Ionization, photoelectric.	21	Each	9,586.90	201,324.90
169/24	Supply, installation and commisioning of Addressable Heat Detectors incorporating an LED indication located in labyrinth with in the housing of the detector adjustable Sensing unit via software between 0-90 seconds. The detector shall have built in short circuit isolators on both inputs, made of Ademco/ Honeywell/ Bosch/ Eaton (UK) or equivalent as approved and directed by the Engineer Incharge.				
i)	Fixed Heat Detector to Sense High Temperatures	1	Each	7,556.30	7,556.30

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

8-Electrical System Works

Sr. No.	Description	Qty	Unit	Rate	Amount
A.	SCHEDULE ITEMS				
	SUB TOTAL SECTION (C)				511,291.00
				Total Rs:-	4,217,681.70

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

B-Electrical System Works

Sr. No.	Description	Qty	Unit	Rate	Amount
B.	**NON SCHEDULE ITEMS**				
1.0	**DURA DUCT**				
1.01	Supply & Installation of following sizes PVC dura duct **make ADAMJEE/POPULAR or approved equivalent** to be installed on work station including all installation accessories, complete in all respects.				
i)	25mmx25mm.	35	Meter		
	SUB TOTAL SECTION (1.0)				
2.0	**VOICE SYSTEM**				
2.01	Supply, Laying and Connection up of following size telephone cable **make PAKISTAN/PONY** or approved equivalent 0.6mm solid conductor twisted together conducter, complete in all respects.				
i)	50 pairs.	12	Meter		
2.02	Supply, Laying and Connection up of following 16-SWG sheet steel with electrostatic painted wall recessed hanged door duct proof telephone junction box (TJB) with connecting modules of **make CORNING/NORDEN/KRONE** or approved equivalent and marking arrangement for following Nos. of pairs of cables				
i)	TJB-G (50 pairs).	1	Each		
2.03	Supply, installation & Connection up of following **16-SWG sheet steel with electrostatic painted wall mounted, hanged door, vermin & dust proof and weatherproof type IP-65 telephone junction box** (FTJB) with connecting modules of **make KRONE/3M/NORDEN** or approved equivalent and marking arrangements for following Nos. of pairs of cables				
i)	FTJB (30 pairs).	1	Each		
	SUB TOTAL SECTION (2.0)				

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT & MANAGEMENT COMPANY.

EXTENSION OF HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE, SUNDAR.

BILL OF QUANTITIES (GF)

9-Elevation Finishing Works

Sr.No.	MRS 1 st (Annual 2025)	DESCRIPTION	UNIT	QUANTITY	RATE (Rs.)	AMOUNT (Rs.)
1	2	2	3	4.00	5.00	6 (4 x 5)
	A	SCHEDULED ITEMS				
1	13/33 P-91	Providing and applying weather shield paint of approved quality on external surface of building including preparation of surface, application of primer complete in all respect: a) new surface: 1st coat & 2nd coat	S/f	18,955.21	74.21	1,406,666.19
				Sub Total (A)		1,406,666.19
	B	NON SCHEDULED ITEMS				
		PRECAST COLUMN CLADDING				
1	NSI	Providing, cutting and fixing in final position of Precast Columns Cladding on Corridore columns (Size: upto 1'-6" dia to 2'-0" dia) as per approved design, size using cement sand gola fixed with cement sand mortar (Nero), including cost of labour and scaffolding. Complete in all respect and conforming to the requirements of drawings, specification and to the entire satisfaction of the Architect/Engineer.	Rft	73.00		
		TOTAL OF NON SCHEDULED ITEMS (RS.)		Sub Total (B)		

BUILDING INTERIOR WORKS FOR EXTENSION OF PIEDMC HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE

Contract # PIE/P&C/HO/25/32

Commented [N1]: Please update

TECHNICAL SPECIFICATIONS
VOLUME-III

June 2025

TECHNICAL SPECIFICATIONS

C O N T E N T S

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SPECIFICATIONS PLUMBING WORKS

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Chapter-1
Demolition

1.0 GENERAL

SCOPE

The work under this section consists of demolition, R.C.C / R.B. roof, floors of any types, taking out doors and windows etc. including all necessary arrangements and requirements for performing all the works for the complete execution as shown on the drawing or as directed by the Project Manager. The scope of this section is covered with detail specifications as laid down herein:

2.0 SUBMITTALS

Submit proposed methods and operations of demolition works to the Consultant for review prior to start of work.

Provide detail sequence of the demolition and renoval works to ensure unintruption.

3.0 SCREENS

If directed by the Project Manager, the Contractor shall provide, erect and remove screen of canvas or other suitable material to minimize the nuisance from dust and shall provide watering as the work of demolition proceeds.

4.0 DIVERSION OF SERVICE

The existing services such as electric supply, telephone connections, water supply, drainage etc. shall be directed according to the directions and to the satisfaction of the Project Manager.

5.0 INVENTORY OF SERVICEABLE MATERIAL

Before taking the work of demolition in hand, an inventory of all serviceable materials for which special core is to be exercised in demolition, handling or lowering down shall be made & the list shall be checked and dully approved by the Project Manager or his authorized representative.

6.0 DAMAGE MADE GOOD BY THE CONTRACTOR.

6.1 The Contractor shall responsible for carrying out dismantling operations strictly in accordance with the specifications or directions of the Project Manager with appropriate tools in such a manner as to avoid un-necessary damage or injury to other adjoining works and those parts of work which are to be retained.

6.2 All responsibilities of risk connected with the demolishing works shall rest with Contractor, if damaged, shall be replaced or made good by the Contractor at his own expanses.

7.0 **SEWER AND DRAINS.**

The Contractor shall at once remove all foul materials, if sewers or drains are to be removed or directed, the rate for removing pipes, doors not included in excavation or the demolition of any masonry then all the works shall be paid for separately, in according to their respective rates.

8.0 **DOORS AND WINDOWS**

Doors and windows/shutters shall be removed along with chowkats, their hinges before dismantling and shall be carefully carried and stacked where ever directed by the Project Manager.

9.0 **STACKING OF MATERIAL**

Unless otherwise specified, all demolished material shall be considered the property of the Client / Government. The rate of an item shall be included the sorting out any demolished material, its stacking any where and its safe custody till it is handed over to the department in accordance with directions of the Project Manager.

10.0 **DISPOSAL OF SURPLUS MATERIAL**

10.1 The rejected, un-suitable material shall be disposed off outside munciple limit.

10.2 The disposal of surplus un-suitable material shall includes, loading, unloading, transportation as directed by the Project Manager.

11.0 **MEASUREMENTS**

Measurements of the actual work completed will be made according to the Bill of Quantities.

12.0 **RATE & PAYMENT**

The payment shall be made at the unit rates stated in the Bill of Quantities, such payments shall constitute of full compensation for all equipment, labour including all incidents, necessary to complete the work.

Chapter-2
Stake-Out Survey

1.0 SCOPE

Under this item the Contractor shall make the stake-out survey for construction purposes with competently qualified men, consistent with the current practices. The work shall proceed immediately upon the award of the contract and shall be expeditiously progressed to completion in a manner and at a rate satisfactory to the Project Manager. The Contractor shall keep the Project Manager fully informed as to the progress of the Stake-out survey. The scope of this section of specifications is covered by detailed specifications as laid down herein.

2.0 MATERIAL

All instruments, equipment, stakes and other material necessary to perform all work shall be provided by the Contractor. These instruments and equipment shall be available to Project Manager at all times for the purpose of checking the work of the contract.

3.0 EXECUTION

The Contractor shall trim trees, bushes and other interfering objects, not consistent with the plans, from survey lines in advance of all survey work to permit accurate and unimpeded work by his stake-out survey crews and the Project Manager 's survey crews. The exact position of all work shall be established from control points which are shown on the plans or modified by the Project Manager . Any error, apparent discrepancy or absence in or of data shown or required for accurately accomplishing the stake-out survey shall be referred to the Project Manager for interpretation of furnishing when such is observed or required.

The Contractor shall be responsible for the accuracy of his work and shall maintain all reference points, stakes, etc. throughout the life of the contract. Damaged, destroyed or inaccessible reference points, bench marks or stakes shall be replaced by the Contractor. Existing or new control points that will be or are destroyed during construction shall be re-established and all reference ties recorded thereof shall be furnished to the Project Manager . All stake-out survey work shall be referenced to the centre lines shown on the plans. All computations necessary to establish the exact position of the work from control points shall be made and preserved by the Contractor. All computations, survey notes and other records necessary to accomplish the work shall be kept neatly and made available to the Project Manager upon request and furnished to the Employer upon contract completion.

The Project Manager may check all or any portion of the stake-out survey work or notes made by the Contractor and any necessary correction to the work shall be immediately made. Such checking by the Project Manager shall not relieve the Contractor of any responsibilities for the accuracy or completeness of his work.

Reference points, base lines, stake and bench marks for borrow pits shall be established by the Contractor.

All required right-of-way and easement limits shall be established, staked and referenced by the Contractor concurrent with the construction stake-out survey.

The Contractor shall place at least two offset stakes or reference at each centre line station and at such intermediate stations as the Project Manager may direct. From computations and measurements made by the Contractor, these stakes shall be clearly marked with the correct center line, station number, offset and cut or fill so as to permit the establishment of the true centre line location during construction. He shall locate and place all cut, fill, slope, line grade or other stakes and points as the Project Manager may direct to be necessary for the proper, progress of the work.

4.0 PAYMENT

No payment shall be made for the works involved within the scope of this section of specifications unless otherwise specifically stated in the bill of quantities or herein.

The cost therefore shall be deemed to have been included in the other items of the bill of quantities.

Chapter-3
EXCAVATION

1.0 SCOPE

The work covered by this section of the specification consists in furnishing all plant, labour, equipment, appliances and materials, and in performing all operations in connection with excavation, trenching and backfilling, in strict accordance with this section of specification and the applicable drawings, and subject to the terms and conditions of the CONTRACT.

2.0 CLEARING AND GRUBBING-UP

The sites of all excavation shall be cleared of all shrubs, plants, bushes, large roots and other surface materials. All such materials shall be removed and disposed of in a manner satisfactory to the SITE ENGINEER. All trees and shrubbery that are designated by the SITE ENGINEER to remain shall be adequately protected and preserved in an approved manner.

3.0 EXCAVATION

All excavation, in any kind of soil encountered, shall be performed to the depths and widths indicated or as otherwise specified. During excavation, material suitable for backfilling shall be stockpiled in an orderly manner at a sufficient distance from the banks of the excavation to avoid overloading and to prevent sides from caving. Topsoil shall be stockpiled separately, for subsequent re-use as necessary. All excavated material unsuitable or not required for backfilling shall be removed and collected at a location approved by the SITE ENGINEER. Grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulated therein shall be removed by pumping or by other approved methods. Unless otherwise indicated or approved by the SITE ENGINEER, excavation shall be open cut.

It is anticipated that all excavation work under this CONTRACT, will be earth excavation. The term “earth” as used herein shall include all materials which do not in the opinion of the SITE ENGINEER, require blasting, barring or wedging of material for removal from its original bed.

The CONTRACTOR shall provide adequate timbering or sheeting for excavation where necessary, as part of the excavation work, to hold up the sides and ends of all excavations. Should the sides and ends of any excavation give away, the CONTRACTOR shall, at no extra cost to the EMPLOYER reinstate all disturbed ground. Any excavation carried beyond the limits shown on the drawings and specified herein as the payment limits, shall be treated as excess excavation and dealt with in the manner stated hereinafter.

When foundation level is reached, the SITE ENGINEER will inspect the exposed bottom and give directions as to what further excavation, if any, he considers necessary. The excavation shall be done in such a manner as to ensure that the work rests on a solid and perfectly clean foundation. Where excavation is to be covered subsequently by permanent construction, the CONTRACTOR shall, immediately after exposing the specified

satisfactory foundation proceed with the construction on that foundation. If the CONTRACTOR allows any portion of such foundation to deteriorate due to exposure, he shall make good the foundations at no extra cost to the EMPLOYER and to the satisfaction of the SITE ENGINEER.

4.0 As part of the work, under the excavation items, the CONTRACTOR shall shore up all buildings, walls poles and other structures, the stability of which is liable to be endangered by the execution of the work and shall be fully responsible for all damages to life or property resulting from any default of the CONTRACTOR.

5.0 If ordinary open-cut excavation is not possible or advisable, sheeting and bracing shall be furnished and installed in excavations generally in accordance with the details shown on drawings to provide safe working conditions. The CONTRACTOR shall furnish and place all sheeting walls, braces, timbers, and similar items, necessary for the safety of the work, the general public and adjacent property. Sheeting and bracing shall be removed, as the work progresses in such manner as to prevent damage to finished work and adjacent structures and property. As soon as it is withdrawn, all voids left by the sheeting and bracing shall be carefully filled with selected material and compacted. The CONTRACTOR shall be fully responsible for the safety of work in progress, for the finished work, the workmen, the public and adjacent property. All sheeting and bracing shall be at the CONTRACTOR'S expense, as part of the work under the excavation items and at no extra cost to the EMPLOYER.

6.0 All excavation made hereunder shall be properly maintained while they are open and exposed. Sufficient suitable barricades, warning lights, signs and similar items shall be provided by the CONTRACTOR. The CONTRACTOR shall be responsible for any personnel injury or property damage due to his negligence.

7.0 As part of the work under the excavation items, and at no extra cost to the EMPLOYER, the CONTRACTOR shall build all drains and do ditching, pumping, well pointing, bailing and other work necessary to keep the excavation clear of ground, sewage or storm water during the progress of the work and until the finished work is safe from injury. The CONTRACTOR shall provide all necessary pumping equipment for the dewatering works as well as operating personnel, maintenance, power etc. all at no extra cost to the EMPLOYER. All water pumped or drained from the work shall be disposed of in a manner satisfactory to the SITE ENGINEER. Necessary precautions against flooding shall be taken.

8.0 The SITE ENGINEER may order, in writing, any or all shoring, sheeting and piling to be left in place for safety reasons, whether such sheeting was shown on drawings or not. If left in place, such sheeting shall be cut of at the elevation approved by the SITE ENGINEER, and shall be driven tight and shall be paid for at the tendered rates.

9.0 The CONTRACTOR shall take special precautionary and protective measures with existing subsurface facilities likely to be encounted during the execution of works such as sewers, drain pipes, water mains, conduits, electric cables, communication cables and the foundations of adjacent structures. The CONTRACTOR shall be responsible for damage to any such facility and shall repair the same at his expense whether or not this facility has been shown on the drawings.

10.0 All surplus material excavated by the CONTRACTOR shall be disposed of at locations approved by the SITE ENGINEER. The method of disposal shall not interfere with other works and shall not damage or spoil other material. When it is necessary to haul earth material over streets or pavements, the CONTRACTOR shall prevent such material from falling on the streets or pavements.

11.0 After the completion of water lines, sewer lines, drainage facilities, foundations, walls and other structures below the elevation of the final frade, all voids shall be backfilled with suitable materials, as specified below.

12.0 Backfilling operations for structure shall be performed as part of the CONTRACTOR'S work under the payment items for earth excavation, and at no extra cost to the EMPLOYER. Backfill material for foundations, walls and other structures shall consist of excavated soil which is free from stones and hard clods, larger than 3 inches in any dimension and also free from trash, lumber and other debris. Backfill material shall have enough moisture for proper compaction, and shall be compacted in an approved manner to 85 percent of maximum density for cohesive soil and 90 percent of maximum density for cohesionless soil. Backfill shall not be placed against foundation walls earlier than 4 days after the placing if concrete or brick work. After compaction and satisfactory completion of backfilling the CONTRACTOR shall carry out the finished grading of the site to such grades and elevations as may be shown on the drawings or required for proper drainage of the site.

13.0 The trenches for sewers shall be backfilled to the specified level with selected excavated material or other approved material that is suitable for proper compaction. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted to the specified density.

Normal backfilling operations in trenches shall be performed as part of the CONTRACTOR'S work under the payment items for earth excavation and at no extra cost to the EMPLOYER.

14.0 Special sand backfill is to be provided when specifically required by the drawings or when ordered in writing by the SITE ENGINEER. This work shall consist of removal of the excavated material to waste and provision in lieu of graded clean and fill, free of all foreign matter, such that 100% passes a ¾" screen with not more than 5% passing a No.4 sieve. This shall be compacted to 95% of maximum density.

15.0 The maximum density of soil shall be determined in accordance with American Society for Testing Materials (ASTM) Standard D 698-58T "Moisture Density Relations of Soils, using 5.5 lbs. Rammer and 12 inch Drop".

16.0 The SITE ENGINEER will take tests using the calibrated sand cone method to determine the density of soil in place. If soil in place fails to meet the specified degree of compaction it shall be removed, replaced with approved material and compacted to the specified density in the manner directed by the SITE ENGINEER, in the areas represented by the failing tests at no additional cost to the EMPLOYER.

17.0 Where satisfactory materials for backfill are not available in sufficient quantity from required excavation, “Earth Borrow” shall be obtained from suitable sources at the CONTRACTOR’S responsibility as a separate payment item. The necessary clearing and grubbing of borrow areas, disposal and burning of debris therefrom the developing of sources including any access roads for hauling and the necessary right-of-way, and the satisfactory drainage of the borrow areas, shall be considered as incidental items to borrow excavation. “Earth Borrow” under this separate payment item shall be furnished and placed by the CONTRACTOR only where specifically called for by means of notes on the contract drawings or by written order of the SITE ENGINEER.

18.0 This section of specification covers the following payment items:

a) Earth Excavation
b) Special Sand Backfill
c) Earth Borrow
d) Shoring and Sheeting Left in place

18.0 Measurement of Earth Excavation shall be carried out by computing the volume of earth excavation which is authorised for payment, as per dimensions shown on the drawings.

Payments for Earth Excavation shall be made at the respective unit rates per cubic feet as listed in the Bills of Quantities of this contract.

19.0 This payment item shall be used in connection with backfill in trenches, floors and foot paths etc. Measurement of special sand backfill shall be carried out by computing the volume of special sand backfill authorised for payment.

Payment for Special Sand Backfill shall be made at the unit rate per cubic feet stated in the applicable Bill of Quantities of this contract. The quantities indicated in the Bill of Quantities are provisional.

CHAPTER-4
PLAIN AND REINFORCED CONCRETE

1.0 SCOPE

The work covered by this section of Specifications consists of furnishing all plant, labour, equipment, appliances and materials, and in performing all operation in connection with the supply and installation of plain and reinforced concrete work, complete in strict accordance with this section of the Specifications and the applicable drawings, subject to the conditions of the CONTRACT.

2.0 GENERAL

a. Full co-operation shall be given to other trades to install embedded items.

b. Suitable templates or instructions, or both will be provided for setting items not placed in the forms. Embedded items and their locations shall have been inspected and mix for concrete and test required for quality of other materials or for mechanical operations shall have been completed and approved, before concrete is placed.

c. For special concrete finishes and for special methods of construction e.g. slip forms, form work shop drawings shall be designed and prepared by the CONTRACTOR at his own cost. Approval of shop drawings as well as that of actual samples of finished concrete shall be obtained before WORK is commenced.

d. CONTRACTOR shall also prepare BAR BENDING SCHEDULE and get the same approved by the Project Manager prior to the commencement of work.

e. Approximate equivalent conversion of F.P.S. and S.I. units are indicated in the text. Project Managers's decision on any specific conversion shall be final and binding on all parties.

3.0 RELATED SPECIFICATIONS

Latest editions of the following. British, ASTM and ACI Standards are relevant to these Specifications where indicated:- (Equivalent Pakistan Standards are also applicable.)

a. British Standards:

R.S. 12-78	Portland Cement, Ordinary and Rapid Hardening (in lieu of C-150).
B.S.410	Test Sieves.
B.S. 693	General Requirements for Oxyacetylene Welding of Mild Steel
B.S. 822-1201	Concrete aggregates from Natural Sources.

B.S.I 141	Cold. Worked Steel Bars for the reinforcement of Concrete. General Requirements for the Metal - Arc Welding of Mild Steel.
B.S. 1881	Methods of Testing Concrete.
B.S. 3148	Tests for water for Making Concrete.
B.S. 4027	Sulfate-Resisting Portland Cement.
B.S. 4449	Hot Rolled Steel Bars for the Reinforcement of Concrete.
B.S. 4461	Cold Worked Steel Bars for the Reinforcement of Concrete.
B.S. 4466	Bending Dimensions and Scheduling of Bars for the reinforcement of Concrete.

b. ASTM Standards:

A 615	Deformed Billet-Steel Bars for Concrete Reinforcement.
C 33-78	Standard Specification for Concrete Aggregates.
C 39-72	Compressive Strength of Cylindrical concrete Specimens.'
C 42-77	Standard Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
C 94-78	Standard Specification for Ready Mixed Concrete.
C 138-71 T	Tentative Method of Test, for Weight per Cubic Foot. Yield, and Air Content (Gravimetric) of Concrete.
C143-78	Standard Method of Test for Slump of Portland Cement Concrete.
C 150-72	Standard Specification for Portland Cement.
C 171-69	Standard Specification for Sheet Materials for Curing Concrete.
C 172-71	Standard Method of Sampling fresh Concrete.
C 173-71	Standard Method of Test for Air Content of freshly Mixed Concrete by the Volumetric Method.
C 208-72	Standard Specification for Insulating Board (Cellulosic Fiber) Structural and Decorative.
C231-72T	Tentative Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method.

C 260-77 Standard Specifications for Air Entraining Admixtures

C 309 Standard Specification for Liquid Membrane-Forming Compounds for curing Concrete.

C 494-71 Standard Specification for Chemical Admixtures for Concrete.

E 329-70 Recommended practice for Inspection & Testing Agencies for Concrete & Steel as Used in Construction.

c. In addition, the latest editions of other Pakistan and British Standards. American Concrete Institute Standards, American Society for Testing and Materials Standards and other Standards as may be specified by the Project Manager for special Materials and Construction are also relevant.

4.0 MATERIALS

4.1 Aggregates (Except for light-weight concrete):

a. The sources of supply of all fine and coarse aggregates shall be subject to the approval of Project Manager.

b. All fine and coarse aggregates shall be clean and free from clay, loam, silt and other deleterious matter. If required, Project Manager reserves the right to have them washed by the CONTRACTOR at no additional expenses. Coarse and fine aggregates shall be delivered and stored separately at SITE. Aggregates shall not be stored on muddy ground or where they are likely to become dirty or contaminated.

c. Fine aggregates shall be hard coarse sand, crushed stone or gravel screenings, and shall conform to requirements of ASTM C-33.

d. Coarse aggregates shall be gravel or broken stone or hard, durable material free from laminated stone and conforming to ASTM C-33 graded as follows for use in mass concrete such as in foundations:

TOTAL PASSING		**PERCENT BY WEIGHT**
2" B.S	Sieve (50.00 mm)	100
1-1/2"	Sieve (38.10 mm)	95 - 100
3/4"	Sieve (19.00 mm)	35 - 70
3/8"	Sieve (9.50 mm)	10 - 30
No. 4	Sieve (4.75 mm)	0 - 5

Coarse aggregates for all cast-in-place concrete other than mass concrete and thick fair faced cast-in-place concrete shall be graded with the following limits:-

TOTAL PASSING		PERCENT BY WEIGHT
1"	Sieve (25.00 mm)	100
3/4"	Sieve (19.00 mm)	90 - 100
3/8"	Sieve (9.50 mm)	20 - 55
No. 4	Sieve (4.75 mm)	0 - 10

Coarse aggregates for thin fair faced cast-in-place concrete shall be graded as follows:-

TOTAL PASSING		PERCENT BY WEIGHT
1/2"	Sieve (12.50 mm)	100
3/8"	Sieve (9.50 mm)	85 - 100
No. 4	Sieve (4.75 mm)	10 - 30

e. The nominal maximum size of aggregate for precast fair faced concrete shall be smallest of the following:

i. One-fifth of the narrowest dimensions between sides of forms.
ii. One-third of the depth of slabs.
iii. Three-fourth of the minimum clear distance between reinforcing bars or between bars and form.
iv. 1/2" (12.0 mm).

f. The nominal maximum size of the aggregate for normal weight precast concrete shall be smallest of the following:-

i. One-fifth of narrowest dimension between forms.
ii. One-third of depth of slab.
iii. Three-fourth of clear distance between bars.
iv. 1”

Note: The above suggestions for sieve analysis are subject to the seive analysis of the approved design mix which the contractor will produce at that time.

g. The aggregates shall be stockpiled for a period before use so as to drain nearly to constant moisture content (as long as SITE and other conditions permit, preferably for at least a day). The grading of the coarse and fine aggregates shall be tested at least once for every 50 tons (or 750 C ft) supplied to ensure that the grading is uniform and the same as that of the samples used in the preliminary tests.

4.2 Cement

a. Cement shall conform to ASTM C-150.

b. Only one brand of each type of cement shall be used for concrete in any individual member of the structure.

c. Cement shall be used in sequence of receipt of shipment, unless or otherwise directed. There shall be sufficient cement at SITE to ensure that each section of WORK is completed without interruption. If the cement is supplied by THE EMPLOYER, the CONTRACTOR shall inform Project Manager of his requirement much before its use in construction.

d. Cement reclaimed from cleaning of bags or from leaky containers shall not be used.

e. CONTRACTOR shall provide and erect, at his own cost, in a suitable place, dry, well ventilated, and water proof shed of sufficient capacity to store the cement.

f. The cement shall be used as soon as possible after delivery, and cement which Project Manager considers has become stale or unsuitable through absorption of moisture from the atmosphere or otherwise shall be rejected and removed immediately from the SITE at CONTRACTOR'S expense. Any cement in containers, damaged so as to allow the contents to spill or access of the atmosphere to the cement prior to opening at the time of concrete mixing shall be rejected and removed immediately from the SITE at CONTRACTOR'S expense.

g. The mixing together of different types of cement shall not be permitted.

h. Any cement bag having lumps shall be considered as contaminated and not be allowed to be used in any work.

i. Stacking of Cement Bags

Stacks of not more than 10 bags in height shall be used. Ventilation, allowing free flow of air through the stacks specially at the bottom of the stacks would be necessary.

4.3 Water

Clean and clear potable water which does not have sweet, saline or brackish taste shall be used for mixing and curing of concrete. Where doubt exists, the strength of mortar sample made with questionable water is compared with mortar sample produced with acceptable water (like distilled water). The questionable water may be accepted if the sample concrete has strength of at least 90% of the other made sample with acceptable water.

Water contaminants under no circumstance shall be greater than following limits:-

Oil	----------	0.00 ppm.
Chlorides	----------	1000 ppm.
Sulfates	----------	1000 ppm.
Turbidity	----------	2000 ppm.
Acids	----------	10,000 ppm.

Potassium and NaOH 0.5 to 1.0% by weight of cement.

Sea water shall not be used for any reinforced concrete works or where concrete is later required to be plastered, painted or otherwise decorated.

4.4 Reinforcement:

a. Reinforcement for RCC concrete shall conform to the respective British, ASTM or other standards as specified in the Drawings and CONTRACT Documents or as may be specified by Project Manager.

b. Unless otherwise specified, all plain reinforcing bars shall comply with the requirements of B.S. 4449 for plain mild steel bars and shall have a minimum yield stress of 36 ksi, (248 N/mm sq).

c. Unless otherwise specified, all deformed reinforcing bars shall comply with the requirements of B.S. 4461 for deformed cold worked steel bars and shall have minimum characteristic stress of 66 ksi, (460 N/mm sq). with minimum elongation of 12%.

d. Reinforcement shall be obtained only from the manufacturer approved by the Project Manager. If and when required CONTRACTOR shall provide all necessary facilities to Project Manager for the selection of test pieces and shall cause these to be prepared and submitted where directed for tests at CONTRACTOR'S cost.

e. If the reinforcement is to be supplied by the EMPLOYER, the CONTRACTOR shall inform Project Manager of his requirements much before its use in construction.

f. CONTRACTOR shall report immediately on receipt of any consignment, having any deviation in the standard weights of the reinforcing bars beyond those allowed in respective standards mentioned in clause (4.4.b) and (4.4.c) herein before.

4.5 Reinforcement Fixing:

a. All metal for reinforcement shall be free from loose mill scale, loose rust, mud, oil, grease, or other harmful matter immediately before the concrete is placed.

b. Reinforcement is to be accurately placed as shown in the Drawings, and secured against displacement by using 18-20 gauge black annealed wire ties or suitable slips at intersections and supported from the formwork by using concrete, metal or plastic chairs and spacers or hangers of an approved pattern. Where concrete blocks are used for ensuring the cover they shall be made of mortar not leaner than 1 part of cement to 2 parts of sand. Where the concrete surface will be exposed to the weather in the finished structure the portions of all accessories in contact with the formwork shall be galvanized or shall be made of plastic.

c. Bars used for concrete reinforcement shall be fabricated in accordance with the dimensions shown in the Bending Schedule.

d. The cutting tolerance for all bars shall be +/-1" (+/- 25 mm).

e. Where an overall or an internal dimension of a bent bar is specified in the schedule, the bending tolerance, unless otherwise stated, shall be as in Table I.

TABLE I - BENDING TOLERANCES

DIMENSIONS OF BENT BARS				**TOLERANCE**			
Over		**Upto and Including**		**Plus**		**Minus**	
Inches (mm)		**Inches (mm)**		**Inches (mm)**		**Inches (mm)**	
-	-	36	915	1/8	3	1/4	6.0
36	915	72	1830	1/4	6.3	1/2	12.5
72	1830	--	--	1/2	12.5	1	25.0

f. Bars shall be placed to the following tolerances:

i. Concrete cover to formed surface: +/- ¼" (6.0 mm)

ii. Minimum spacing between bars +/- ¼" (6.0 mm)

iii. Top bars in slabs and beams:

- Members 8" (200 mm) deep or less: +/- ¼" (6.0 mm)
- Members more than 8" (200 mm) over 24" (600 mm) deep: +/- ½" (12.0 mm)
- Members more than 24" (600 mm) deep: +/- 1" (25.0 mm)

iv. Crosswise of member: space evenly with 1" (25 m)

v. Lengthwise of members: +/- 2" (50.0 mm)

g. Bars may be moved as necessary to avoid interference will other reinforcing steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, resulting arrangement of bars shall be subject to approval of the Project Manager.

h. Vertical bars in column shall be offset at least one bar diameter at lapped splices. To ensure proper placement, templates shall be furnished for all columns dowels.

i. Reinforcement shall not be bent or straightened in a manner that will injure the material.

No bars shall be bent twice in the same place, nor they be straightened after bending.

Unless permitted by the Project Manager, reinforcement shall not be bent after being partially embedded in hardened concrete. Bars which depend for their strength on cold working shall not be heated for any reason (except for welding) Reinforcement larger than 1-1/2" (38.0 mm) in dia may lie bent by the use of heat (not exceeding 1550 F). Bars bent shall not be cooled by quenching.

j. No splice of reinforcement shall be made except as shown on the working Drawings.

k. Welding shall be permitted for bars only under suitable conditions and with suitable safeguards in accordance with B.S 693. 1856, or AWS D 12.1 provided the type of reinforcement bars have the required welding properties. Tack welding may be used to fix in position bars that cross each other, only with prior approval of the Project Manager.

l. Exposed reinforcement intended for bonding with future extensions is to be effectively protected from corrosion. Protection is also to be provided to reinforcement partly built into concrete exposed part to be built into later concrete.

m. No concreting is to be carried out until the reinforcement has been checked and approved by the Project Manager.

5.0 CONCRETE

5.1 General

a. The proportions of ingredients of structure concrete shall be decided by trial mixes / mix design for the concrete of required compressive strength and shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement by the methods of placing and consolidation allowed to employ on the WORK, but without permitting the materials to segregate or excessive free water to collect on the surface. Specific approval of the Project Manager is required to waive limitations on mixture proportions.

b. The proportions of ingredients shall be selected in accordance with Section 5.6 to produce the proper placeability, durability, strength and other required properties.

5.2 Strength:

The Specified compressive strength of the concrete cylinder, shall be 3200 psi. at 28 days except where otherwise noted on Drawings. The corresponding minimum compressive strength of 6" concrete cube shall be 4000 psi (4 Ksi) at 28 days. Strength requirements shall be based on the sampling and testing methods of ASTM C 39-72 (and BS 1881 for cube).

5.3 Water Content of Concrete:

Maximum permissible water-cement ratios for concrete in severe exposures to be as follows, unless lower water-cement ratio is required to meet specified strength limits:

Type of Structure	**Structure** continuously wet or Frequently freezing and thawing	**Structure** exposed to sea or sulfates
i. Thin sections & sections with less than 1" cover over steel.	0.45	0.40[2]
ii. All other Structures	0.50	0.45[2]

NOTE:

1. Concrete should also be air-entrained.
2. If S.R. Cement is used permissible water-cement ratio may be increased by 0.05.

5.4 Slump:

Unless otherwise permitted or specified, the concrete shall be allowed to have a slump of 1-1/2" (37.50 mm) or less provided the requisite cube strength is obtained, A tolerance of upto 1/2" (12.50 mm) above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, docs not exceed the maximum limit. Concrete of lower than usual slump may be used provided it is properly placed and consolidated. The slump shall be determined by the "Test for Slump for Portland Cement Concrete" (ASTM C-143).

5.5 Admixtures

If required or permitted, admixtures used shall be in accordance with the manufacturer's instructions except as otherwise specified herein.

5.6 Methods of Obtaining Mix Design;

For concrete of normal weight, mix proportions to provide the desired characteristics shall be developed by using the methods/procedure covered by the latest edition of Recommended Practice for Selecting Proportions for Normal Weight Concrete ACI 211.1.

Trial mixtures having proportions and consistencies suitable for the WORK shall be made based on ACI 211.1, using at least three different water-cement ratios which will produce a range of strengths encompassing those required for the WORK. Trial mixes shall be designed to produce the specified slump. The temperature of concrete used in trial batches shall be reported.

For each water-cement ratio, compression test of cylinder/cube shall be made, cured, and tested in accordance with "ASTM C - 39 or BS 1881". From the results of these tests a curve shall be plotted showing the relationship between the water-cement ratio and compressive strength. From this curve, the water-cement ratio to be used in the concrete shall be selected to produce the required/specified design strength. The cement content and mix proportions to be used shall be such that this water-cement ratio is not exceeded when slump is the maximum permitted. Control in the field shall be based upon maintenance of proper cement content and slump.

5.7 Batching:

a. All cement, including cement supplied in bulk, shall be batched by weight. A bag of cement, unless marked otherwise, may be taken as 112 Ibs (50 kg) or as directed by the Project Manager.

b. Aggregate shall be batched by weight, duly allowance being made for water content. Aggregate may be batched by volume only with the prior permission of Project Manager. The apparatus for weight batching may be an integral part of the mixer or a separate unit of a type approved by Project Manager. It shall be accurate within 2% and shall be checked for accuracy at least once a week.

c. Where the batching plant is of the type in which cement and aggregate are weighed in the same compartment, the cement shall be introduced into the compartment between two sizes of aggregate.

d. Where volumetric batching of aggregate is permitted, gauge boxes shall be provided for measuring the coarse and-the fine aggregate. These shall be deep and narrow rather than shallow and wide. Tests for the bulking of sand shall be made at intervals and the necessary quantity of sand added.

e. Each batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates. Water shall continue to flow for a period which may extend to the end of the first 25 percent of the specified mixing time.

5.8 Mixing

a. The concrete shall be mixed in an approved batch mixer conforming to the requirement of B.S 1305. It shall be fitted with the manufacturer's plate stating the rated capacity and the recommended number of revolutions per minute and shall be operated in accordance therewith. It shall he equipped with a suitable charging mechanism and an accurate water measuring device.

b. Mixing shall continue for the period recommended by the mixer manufacturer or until apparently the mix is uniform in color, whichever period is longer. If it is desired to use a mixing period less than 1-1/2 minute Project Manager approval shall be obtained in writing.

c. Controls shall be provided to ensure that the batch cannot be discharged until the required mixing time has elapsed. At least three quarters of the required mixing time shall take place after the last of the mixing water has been added.

d. The interior of the mixer shall be free of accumulations that will interfere with mixing action. Mixing blades, shall be replaced when they have lost 10% of their original height.

e. Concrete shall be mixed Only in quantities for immediate use. Concrete which has set shall not be re-tempered, but shall be discarded.

5.9 Transportation:

a. The concrete shall be transported from the place of mixing to the place of final deposit as rapidly as practicable by means which will prevent segregation or loss or addition to ingredients. It shall be deposit as nearly as practicable in its final position so as to avoid re-handling or flowing. All skips vehicles, or containers used for transporting the concrete shall be thoroughly cleaned.

b. During hot or cold weather, concrete shall be transported in deep containers to minimize the loss of water/heat.

5.10 Placing

a. Before placing of concrete, form works shall have been completed, water shall have been removed, reinforcement shall have been secured in place, expansion joint material, anchors, and other embedded items shall have been kept in position, and the entire preparation shall have been approved.

b. No concrete is to be placed into the foundation trenches until the ground to receive the same has been examined and approved by Project Manager for this purpose.

c. The actual sequence of construction proposed by CONTRACTOR shall be subject to Project Manager's approval before construction starts on any part of the structure, and this sequence shall not be varied without Project Manager's prior approval.

d. The concrete shall be placed after it has been mixed as soon as practicable. Once the concrete has left the mixer no more water shall be added, although the concrete may be mixed or agitated to help maintain workability. The concrete shall not be used if, through any cause, the workability of the mix at the time of placing is too low for it to be compacted fully and to an acceptable finish by whatever means are available.

The time between mixing and placing should be reduced if the mix is richer or the initial workability of the mix is lower than normal, if a rapid hardening cement or an accelerator is used, or if the work is carried out at a high temperature or exposed to a drying atmosphere. CONTRACTOR shall ensure that the delay between mixing and placing does not exceed 30 minutes under any circumstances. Any concrete which does not satisfy this requirement shall not be used.

e. The concrete shall be deposit as nearly as possible in its final position to avoid re-handling. In no circumstances may concrete be made to flow along the forms by the use of vibrators, Concreting shall be carried out on as a continuous operation using methods which shall prevent separation loss of ingredients.

f. The free fall of concrete shall not be allowed to exceed eight feet and where it is necessary for the concrete to be lowered more than this amount, it is not to be dropped into its final position, but it is to be placed through pipe, the lower end of which shall be kept in, or close to the freshly deposit concrete. The dia of the pipe shall not be than 4 times the maximum size of aggregate.

g. For mass concrete, concrete shall be placed in layers approximately 18" (450 mm) thick. Vibrator heads shall extend into the previously placed layer.

h. The workmen carrying concrete to the SITE, and all other workmen moving about before the concrete is placed shall move only along runways or planks placed over the forms.

i. Prior to the laying of concrete on load bearing masonry walls, bearing plates and at other points, as may be directed by Project Manager, the surface will be brought to a true, hard smooth, level using a cement sand mortar in the ratio of 1 volume of cement to 3 volumes of sand. Two layers of building paper weighing 1.3 oz/sq. ft (400 g/m) will then be laid flat to separate the concrete from the surface on which it is to be laid.

5.11 Construction Joints:

a. Concreting shall be carried out continuously upto construction Joints, the position and arrangement of which shall be pre-determined with the approval of the Project Manager.

b. Joints not shown on the Drawings shall be so made and located as to least impair the strength of the structure and shall need prior approval of Project Manager. In general, they shall be located near the middle of the spans of slabs and beams unless a secondary beam intersects a main beam at this point, in which case the joint in the main beam shall be offset to a distance equal to twice the width of the secondary beam. Joints in walls and columns shall be at the underside of floors slab or beams, and at the top of footings. Beams, brackets, columns, capitals, haunches, and drop panels shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.

c. All reinforcing steel shall be continued across joints. Key and inclined dowels shall be provided as directed by Project Manager. Longitudinal keys at least 1- 1/2 (40 mm.) deep shall be provided in all joints in walls and between walls and slab or footings.

d. When the work is to be resumed on a surface which has hardened, such surface shall be roughened in an approved manner which will expose the aggregate Uniformly and will not leave laitance, loosened particles of aggregate or damaged concrete at the surface.

e. The hardened concrete of construction joints and of joints between footings and walls or columns, between walls or columns and beams or floors they support, joints in un-exposed walls and all others not mentioned below shall be dampened (but not saturated) immediately prior to placing of fresh concrete.

f. The hardened concrete of joints in exposed work, joints in the middle of beams, and slabs and joints in work designed to contain liquids shall be dampened (but not saturated) and then thoroughly covered with a coat of cement grout of similar proportions to the mortar in the concrete The grout shall be as thick as possible on vertical surface and at least 1/2" (12.0 mm) thick on horizontal surface. The fresh concrete shall be placed before the grout has attained its initial set.

g. Where the concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brush. Care being taken to avoid dislodging of particles of aggregate. The surface shall then be coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 6" (150 mm) in thickness, and shall be well rammed against old work, particular attention being paid to corners and close spots.

h. Stop ends for movement joints or construction joints shall be made by splitting them, along the lines of reinforcement or the concrete. Stop ends made of expanded metal or similar material may only be left permanently in the concrete with prior written approval of Project Manager. Where such stop ends are used , no metal may be left permanently in the concrete closer to the surface of the concrete than the specified cover to the reinforcement. Wood strips inserted for architectural treatment shall be kerfed to permit swelling without pressure on the concrete.

5.12 Embedded Items:

a. The material, design and location of water stops in joints shall be as indicated in the Drawings. Each piece of pre-molded water stop shall be of maximum practicable length in order that the number of end joints will be held to a minimum.

Joints at intersections and at end of pieces shall be made in the manner most appropriates to the material being used. Joints shall develop effective water tightness fully equal to that of the continuous water-stop material, and shall permanently develop not less than 50% of the mechanical strength of the parent section, and shall permanently retain their flexibility.

b. Electric conduits and other pipes which are planned to be embedded shall not, with their fittings, displace more than four percent of the area of the cross section of a column on which stress is calculated or which is required for fire protection. Sleeves, conduits, or other pipes passing through floors. walls, or beams shall be of such size or in such location so as not to impair unduly the strength of the construction. Such sleeves, conduits in compression in the displaced concrete, provided that they are not exposed to rusting or other deterioration, are of un-coated or galvanized iron or steel not thinner than standard steel pipe, having a nominal inside diameter not over 2" (50 mm) and are spaced at centers not less than thrice their diameter. Except when plans of conduits and pipes are approved by Project Manager embedded pipes or conduits other than those merely passing through, shall not be larger in outside diameter than one-third or the thickness of the slab, walls, or beam in which they are embedded nor shall be spaced closer than three diameters on center, nor so located as to impair unduly the strength of the construction. Sleeve pipes, or conduits within the limitations! of this section may be embedded in concrete with the approval of Project Manager, provided they are not considered to replace the displaced concrete.

c. All sleeves, inserts, anchors, and embedded items required for adjoining work or for its support shall be placed prior to concreting.

All-Contractors whose work is related to the concrete or must be supported by it shall be given ample notice and opportunity to introduce and/or furnish embedded items before the concrete is placed.

d. Expansion joint material, water stop and other embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

5.13 Consolidation:

a. All concrete shall be consolidated by vibration, so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into comers of form, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Internal vibrators shall have a minimum frequency of 800 vibrations per minute and sufficient amplitude to consolidate the concrete effectively.

Vibrators shall be inserted and withdrawn at points approximately 18" apart (450 mm). At each insertions, the duration shall be sufficient to cause consolidation, generally from 5 to 15 sec. A spare vibrator shall be kept on the SITE during all concreting operations. Where the concrete is to have an as-cast finish, a full surface of mortar shall be brought against the form by the vibration process supplemented if necessary by spading to work the coarse aggregate back from the formed surface.

b. If there is any tendency for the mix to segregate during consolidation, particularly if this produces excessive laitance, the mix proportions shall be modified to affect an improvement in the quality of the concrete to the satisfaction of Project Manager and in conformity with the provisions of Clause 5.

c. Vibrators shall not be allowed to contact the form work for exposed concrete surface.

d. Mechanical vibrators shall be of a type suited in the opinion of Project Manager to the particular conditions.

e. Over-vibration or vibration of very wet mix is harmful and should be avoided.

5.14 Curing and Protection:

a. Beginning immediately after placement, concrete shall be protected from premature drying, excessively hot or cold temperatures, and mechanical injury, and shall be maintained with minimal moisture loss at a relative constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing shall be subject to approval of Project Manager.

b. For concrete surfaces not in contact with forms, one of the following procedure shall be applied immediately after completion and finishing:

- Ponding or continuous sprinkling.
- Application of absorptive mats or fabric kept continuously wet.
- Application of water proof sheet materials approved by Project Manager.
- Application of other moisture retaining covering as per approved.
- Application of curing compound conforming to AS'I'M C 309. The compound shall be applied in accordance with the recommendations of the manufacturer immediately after any sheen which develops after finishing has disappeared from the concrete surface. It shall not be used on any surface against which additional concrete or other materials to be bonded unless it is proved that the curing compound will not prevent bond, or unless positive measures are taken to remove it completely from area to receive bonded applications.

c. Moisture loss from surface placed against wooden forms or metal forms exposed to heating by the sun shall be minimized by keeping forms wet until they can be safely removed. After form removal, the concrete shall he cured until the end of the limit prescribed in Clause 6.10.d by one of the methods of Clause 6.10.b.

d. Curing in accordance with clause 6.10.a & 6.10.b shall be continued for at least 14 days in the case of all concrete except concrete with Rapid hardening Portland cement for which the period shall be at least 7 days.

Alternatively if tests are made of cylinders/cubes kept adjacent to the structure and cured by the same methods, moisture retention measures unless stated otherwise on drawings, may be terminated when the average compressive strength has reached 70 percent of the minimum specified Works strength. If one of the first four curing procedures of clause 6.10.b is used initially, it may be replaced by one of the other procedures of that Clause any time provided the concrete is not permitted to become surface dry during the transition.

e. When the mean daily outdoor temperature is less than 41 degree F (5 C) then temperature of the concrete shall be maintained between 50-68F (10C-20C) for the required curing period of Clause 6.10.d. When necessary arrangements for heating, covering, insulation or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature without injury to concentration of heat. Combustion heaters shall not be used during the first 24 hours unless approved precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.

f. When necessary, provision for windbreak, shading for spraying, sprinkling, ponding or wet covering with a light colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as concrete hardening and finishing operations will allow.

g. Changes in temperature of the air immediately adjacent to the concrete during and immediately following the curing period shall be kept as uniform as possible and shall not exceed 5F (3C) in any one hour or 50F (28C) in any 24 hour period.

h. During the curing period, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials or methods by application of curing procedures, and by rain or running water, self-supporting structures shall not be loaded in such a way as to over stress the concrete.

5.15 Works In Extreme Weather:

a. Unless adequate protection is provided and approval is obtained concrete shall not be placed during rain. Rain water shall not be allowed to increase the mixing water nor to damage the surface finish.

b. When the temperature of the surrounding air is expected to be below 40 degrees F (4.4 C) during placing or within 24 hours thereafter, the temperature of the plastic concrete, as placed shall not be lower than 55 degrees F (13 - C) for sections less than 12" (300 mm) in any dimension nor 50F (1 OC) for any other sections.

When necessary, concrete materials should be heated before mixing and carefully protected after placing; in general, heating of mixing water alone to about 140F (60C) may be sufficient for this purpose. Dependence should not be placed on salt or other chemicals for the prevention of freezing. No frozen material or materials, containing ice shall be used. All concrete damaged by frost shall be removed. It is recommended that concrete exposed to the action of freezing weather should have entrained air and the water content of the mix should not exceed 5.5 gallons (25 liters) per bag of cement. If water or aggregate is heated above I OOF (38C) the water shall be combined with the aggregate in the mixer before cement is added. Cement shall not be mixed with water or with mixtures of wafer and "aggregate having a temperature greater than 100F(38C).

c. During hot weather, (lie temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set, or cold joints and should not exceed 90F (32.C). For massive concrete this temperature should not exceed 70F (21 .C). When the temperature of the concrete exceeds 90F (32C), precautionary measures approved by

Project Manager shall be put into effect. When the temperature of the steel is greater than 122F (50C) steel forms and reinforcement shall be sprayed with water just prior to placing the concrete. The ingredients shall be cooled before mixing, or flake ice or well-crushed ice of a size that will melt completely during mixing may be substituted for all or part of the mixing water if, due to high temperature, low slump, flash set or cold joints are encountered.
Other precautions recommended by ACI standard 305R-91 shall also be adopted.

6.0 TEST FOR CONCRETE QUALITY

6.1 General:

CONTRACTOR shall make standard cylinder / cube (sample) by standard method of concrete for testing at Project Manager's direction. Proper facilities shall be provided for making and curing the test specimens in accordance with the specifications A competent person shall be employed by the CONTRACTOR whose first duty shall be to supervise all stages in the preparation and placing of the concrete. All test specimens shall be made and SITE tests carried out under his direct supervision and at CONTRACTOR'S cost.

Permanent record of concrete poured, samples made, and compressive strength results obtained shall be carefully maintained at the site.

6.2 Samples

Conduct compressive strength tests on at least, one test cylinder / cube sample per 50 cubic yards of concrete (38 cu meters) with a minimum of one sample per concrete pour. Each test sample shall consist of no less than three concrete test cylinders/cubes made from a single sample of concrete from a randomly selected batch of concrete, taken at point of discharge from mixer or truck, cured under standard conditions. One cylinder/cube from each sample shall be tested at age 3 days and two at age 28 days unless otherwise directed by the Project Manager.

6.3 Adequacy of Mix:

In case of Concrete mix, the appropriate strength requirement shall be considered to be satisfied if none of the strengths of the specimen is below the specified strength or if the average strength of the three specimens is not less than the specified strength and the difference between the greatest and least strengths is not more than 20% of that average.

When the results of tests show that the strength of any concrete is below the minimum specified, Project Manager may give instructions for the whole or part of the work concerned to be removed and be replaced at the expense of CONTRACTOR. CONTRACTOR shall bear the cost of any other part of his, or any other CONTRACTORS work, which has to be removed and replaced as a result of the defective concrete. If any concrete is held to have failed. Project Manager may order the proportions of that class of concrete to be changed in order to provide specified strength.

7.0 FINISHING OF FORMED CONCRETE

7.1 General:

a. After removal of forms the surfaces of concrete shall be given one or more of the finishes specified below in locations designated by the Drawing or as specified in Clause 8.5.

b. When finishing is required to match a small sample furnished to CONTRACTOR, the sample finish shall be reproduced on nil area at least 100 square feet in an inconspicuous location designated by Project Manager before proceeding with the finish in the specified location.

7.2 As-Cast Fishes

a. Rough Form Finish:

No selected form facing materials shall be specified for rough form finish surfaces. Tie holes and defects shall be patched. Unless if required to be retained if so directed by Project Manager. Fins exceeding 1/4" (6 mm) in height shall be chipped off or rubbed off. Otherwise, surfaces shall be left with the texture imparted by the forms.

b. Smooth Form Finish:

The form facing material shall produce a smooth hard uniform texture on the concrete.

It may be plywood, tempered concrete-form grade hardboard, metal, plastic paper, or other approved material capable of producing the desired finish. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to the practical minimum. It shall be supported by studs or other backing capable of preventing excessive deflection. Material with raised grain, torn surfaces, worn edge, patches, dents, or other defects which will impair the texture of the concrete surface shall not be used. Tie holes and defects shall be patched. All fins shall be completely removed.

7.3 Architectural Finishes:

a. Textured Finishes:

Textured form liners may be of formed plastic sheet, wood, sheet metal, or other material designated in Drawings. Liner panels shall be secured in forms by cementing or stapling, but not by methods which will permit impressions of nail heads, screw heads washers, or the like to he imparted to the surface of the concrete, unless shown otherwise on the Drawings. Edges of textured panels shall be sealed to each other or to dividing strips, if specified or shown, to prevent bleeding of grout. The sealant used shall be non-staining to the surface.

b. Applied Finishes:

When finishes of plaster or similar trowelled materials are to be applied, the surface of the concrete shall be prepared to ensure permanent adhesion of the finish. If the concrete is less than 24 hours old, it can be roughened with a heavy wire brush or scouring tool. If the concrete is older the surface may be roughened mechanically or by etching with dilute hydrochloric acid. After roughening, the surface shall be washed free of all dust, acid, chemical retarder, and other foreign material before the final finish is applied.

7.4 Rubbed Finishes

The following finishes .shall be produced on concrete with a smooth form finish. Where smooth rubbed finish is to be applied, the forms shall have been removed and necessary patching completed as soon after the cement of the concrete as possible without compromising any structural requirements.

a. Smooth Rubbed Finish:

Smooth rubbed finish shall be produced on newly hardened concrete not later than a day following form removal.

Surfaces shall be wetted and rubbed with carborundum brick or other abrasive until uniform color and texture are produced. No cement grout shall be used other than the cement paste drawn from the concrete itself by the rubbing process.

b. Grout Cleaned Finish:

No cleaning operations shall be undertaken until all contiguous surfaces to be cleaned are completed and accessible. Cleaning as the work progresses shall not be permitted.

Mix 1 part Portland Cement and 1-1/2 part fine sand with sufficient water to produce a grout having the consistency of thick paint. While Portland Cement shall be substituted for a part of the grey Portland Cement in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout and apply the grout uniformly with a brush or a spray gun. Immediately after applying the grout, scrub surface vigorously with a cork float or stone and fill all air bubbles and holes. While the grout is still plastic, remove all excess grout by working the surface with a rubber float, sack or other means. After the surface whitens from drying (about thirty minutes at normal temperature) rub vigorously with clean burlap. The finish shall be kept damp for at least 36 hours after final rubbing.

c. Cork Floated Finish:

1. Remove forms at an early stage, within 2 to 3 days of placement where possible.
2. Remove ties, and all burrs and fins.
3. Mix 1 part Portland cement and 1 part fine sand with sufficient water to produce a stiff mortar.
4. Dampen surface.
5. Apply mortar with firm rubber float or with trowel, filling all surface voids.
6. Apply a small amount of water with a fog spray to prevent too rapid drying of compressed mortar.
7. Apply a small amount of water with a fog sprayer.
8. Produce the final texture with a cork float using a swirling motion.

7.5 Unspecified Finishes:

If the finish is not specified in the Drawings, the following finishes shall be used as applicable:

a. Rough Form Finish;

For all concrete surface not exposed to public view and / or are specified to have subsequent finishing.

b. Smooth Form Finish:

For all concrete surfaces exposed to public view and or are not required to have subsequent finishing.

7.6 Related Unformed Surfaces;

Tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be floated to a texture reasonably consistent with that of the formed surfaces. Final treatment on form surfaces shall continue uniformly across the unformed surfaces.

8.0 REPAIR OF SURFACE DEFECTS:

8.1 General:

a. Any concrete failing to meet the specified strength or not formed as shown on Drawings, concrete with surface beyond tolerances or with defective surfaces which cannot be properly repaired or patched in the opinion of Project Manager shall be removed and replaced at CONTRACTOR's expenses. Project Manager may reject any defective concrete and order it to be cut out in part or in whole and replaced at the CONTRACTOR's expense. Only in case of minor surface defects Project Manager may approve a surface treatment in accordance with the Clause. 9.2

b. All ties and bolt holes and all repairable defective areas shall be patched immediately after the removal of forms.

8.2 Repair of Defective Areas:

a. All honeycombed and other defective concrete shall be removed down to sound concrete. The area to be patched and area at least 6" (150 mm) wide surrounding it shall be dampened to prevent absorption of water from the patching mortar. A bonding grout shall be prepared using a mix of approximately 1 part cement to 1 part fine sand or an approved bonding agent shall then be well brushed/ applied into the surface.

b. The patching mixture shall be made of the same material and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 2-1/2 parts sand by damp loose volume. White Portland cement shall be substituted for a part of the grey Portland cement on exposed concrete in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch.

c. The quantity of mixing water shall not be more than necessary for handling and placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.

d. After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to loose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the parch slightly higher than the surrounding surface to permit initial shrinkage; it shall be left undisturbed for at least one hour before being finally finished. The patched area shall be covered by approved curing compound, except as specified in Clause 9.2 g. Metal tools shall not be used in finishing a patch in a formed wall which will be exposed.

e. Where as-cast finishes are specified, the quantity of patched area shall be strictly limited. The combined total of patched areas in as-cast concrete surfaces shall not exceed 2 square ft. in each 1000 square feet (2 sq. m in each 1000 sq.m) of as-cast surface. This is in addition to form tie patches, if the project design permits to fall within as-cast areas.

f. Any patches in as-cast architectural concrete shall be indistinguishable from surrounding surfaces. The mix formula for patching mortar shall be determined by trial to obtain a good color match with the concrete when both patch and concrete are cured and dry. After initial set, surface of patches shall be dressed manually to obtain the same texture as surrounding surfaces.

g. Patches in architectural concrete surfaces shall be cured continually for 7 days. Patches shall be protected from premature drying to the same extent as the body of the concrete.

8.3 Tie and Bolt Holes;
After being cleaned and thoroughly dampened, the tie and bolt holes shall be filled solid with patching mortar.

8.4 Proprietary Materials:
If permitted or required by Project Manager proprietary compounds for adhesion or as patching ingredients may be used in lieu of or in addition to the foregoing patching procedures. Such compounds shall be used in accordance with the manufacturer's recommendation with prior approval of Project Manager .

9.0 CONCRETE CONSTRUCTION TOLERANCE

Where tolerances are not stated in the Specifications or Driving for any individual structure or feature, maximum permissible deviations from established lines, grades and dimensions shall conform to the following. The CONTRACTOR is expected to set and maintain concrete forms so as to ensure completed work within the tolerance limits. These allowable tolerances shall not relieve CONTRACTOR of his responsibility for correct fitting of indicated materials. These tolerances are not cumulative.

9.1 Variation from the plumb (or as specified for sloped walls).

a. In the lines and surfaces of columns, piers and walls.

- Maximum for the entire ength or height: 3/16" (4.5 mm)

b. For exposed corner columns, control joint grooves and other conspicuous lines.

- Maximum for the entire length or height: 3/16"(4.5 mm)

9.2 Variation from the levels or the grades indicated on Drawings:

a. In floors, ceilings, beam sofits and in arrises.

- Maximum for the entire length: l/4"(omm)

b. For exposed lintels, sills, parapets, horizontal grooves of 50 feet or more in length , and other conspicuous lines:

- Maximum for the entire length: 1/4"(6 mm)

9.3 Maximum allowable constent Variation of the entire building lines from established position of property tines and related position of columns, walls and partitions.

- Maximum for the entire length: 1" (25 mm)

9.4 Variation of the size and locations of sleeves, floors openings and wall openings: 1/4" (6m)

9.5 Variation In cross-sectional dimensions of columns and beams .

Minus: 1/4" (6 mm)
Plus: 1/2" (12.0 mm)

9.5a. In thickness of Slabs & Walls. 1/4" (6mm).

9.6 Footings:

a. Variations in dimensions in plan.

- Minus: 1/2" (12.0 mm)
- Plus (plus variation applied to concrete only, to bars dowels) 2" (50 mm)

b. Misplacement or eccentricity of concrete.

- 2 percent of the footing width in the direction of misplacement but not more than 2" (50 mm)

c. Reduction in thickness
- Minus 5 percent of specified thickness.

9.7 Variation in Steps

a. Rise: 1/8" (3 mm)
Tread: 1/4" (Omm)

b. In consecutive steps

Rise: 1/16" (1.0 mm)
Tread: 1/8" (3 mm)

9.8 Tolerance for Pre-cast Concrete:

Forms must be true to size and dimensions of concrete members shown on the plans and be so constructed that the dimensions of the finished product will be within the following limits at the time of placement of these units in the structure, unless otherwise noted on Project Manager's Drawings.

a. Overall dimensions of members per 10 ft (3 mm): +/- 1/16" (1.0mm)

b. Cross-sectional dimensions' Section less than 3"(75 mm): +/- 1/8" (3 mm)
Section over 3" (75 mm) less than 18" (450 mm): +/- 1/8" (3 mm)
Section over 18" (450 mm): +/- 1/4" (6 mm)

c. Deviations from straight lines in long sections. Not more than 1/8 inch per 10 ft. (3 mm / 3 m)

d. Deviation from specified camber +/- 1/16" (1.5 mm) per 10 fl (3m) of span. Maximum differential between adjacent units in erected position. ¼ inch (6 mm)

9.9 Tolerance for Pavements:

a. Ramps.

- Departure from established alignment +/- 1/4" inch (6 mm)
- Departure from established longitudinal on any line. +/- 1/4" (6 mm) grade
- Departure from transverse template colour except al transverse joints +/- 1/8 inch (+/- 3 mm)
- Departure from transverse template control at transverse joints 1/4"(+/-6 mm) in width of one traffic lane,

9.10 Pavements for Parking Areas:

Twice values listed for ramp pavements.

10.0 PLANT AND EQUIPMENT

10.1 Formwork:

a. Forms shall be used, wherever necessary, to confine the concrete and shape it to the required dimensions. Forms shall have sufficient strength to with stand the pressure resulting from placement and vibration of the concrete and shall have sufficient rigidity to maintain specified tolerances.

Structurally adequate, form work shall also conform to the requirements of the special architectural finishes of the in-situ Plain and Reinforced Concrete specified/or shown on the Drawings. Shop drawings of such form shall be subject to the approval of the Project Manager prior to its use. Project Manager shall refuse concreting of any part which in his opinion may not yield specified finishes.

b. Earth cuts shall not be used as forms for vertical surface or reinforced concrete work Unless required or permitted.

c. Mud centering shall not be permitted without the prior approval of the Project Manager .

d. Form work shall be made of either timber, steel, plywood, proprietary building boards and such special material, as may be shown on the drawings or approved by the Project Manager which gives the required finish to the surface of concrete. Wooden frame! work shall be free from loose knots and shall be well seasoned. For the external concrete finishes 1/16" (1.5 mm) thick mild steel sheet forms shall he used. CONTRACTOR shall furnish shop drawings of such form work prepared on the basis of architectural concept for the approval of the Project Manager.

e. Form work shall conform to the shape, lines and dimensions as shown on the plans, and be so constructed as to remain sufficiently rigid dining the placing and compacting of concrete, and shall he sufficiently tight of prevent loss of cement slurry. The design and engineering of the form work, as well as its construction, shall be the responsibility of CONTRACTOR. Where necessary to maintain the specified tolerances, the form work shall be cambered to compensate for anticipated deflections in the form work due to the weight and pressure of the fresh concrete and due to construction loads.

CONTRACTOR shall establish and maintain in an undisturbed conditions and until final completion and acceptance of the WORK, sufficient control points and bench marks to be used for reference purpose to check tolerances.

f. Requirements for facing materials are given in clause 8 "Finishing of formed Concrete". The maximum deflection of facing materials reflected in concrete surfaces exposed to view shall be 1/240 of the span between structural members.

g. Where natural plywood form finish, grout cleaned finish, smooth rubbed finish, scrubbed finish, or sand floated finish is required, forms shall be smooth (faced with plywood, liner sheets, or prefabricated panels) and true to line, in order that the surfaces produced with required little dressing to arrive at true surfaces. Where any as-cast finish is required, no dressing shall be permitted in the finishing operation.

h. Where as-cast surfaces, including natural plywood form finish, are specified, the panels of materials against which concrete is cast shall be arranged orderly with joints between panels planned in approved relations to opening, building corners, and other architectural features.

i. Where panels for as-cast surfaces are separated by recessed or otherwise emphasized joints, the structural design of the forms shall provide for locating form ties within the, joints so that patches of the holes will not fall within the panel areas.

j. Forms shall not be re-used if there is any evidence of surface wear and tear or defect which would impair the quality of the surface. Forms shall he thoroughly cleaned and properly coated before re-use.

k. The formwork may be designed so that soffits of slabs and sides of beams, columns, and wall may be removed first leaving the forms to the soffits of beams and their supports in position.

l. Positive means, wedges or jacks of accurate adjustment and proper removal of shores and struts shall be provided and all settlement shall be taken up during placing of concrete. Forms shall also be securely braced against lateral deflections.

m. Where concreting of narrow members' is required to be carried out within form work of considerable depth, temporary openings in the sides of the form work shall be provided where necessary to facilitate the placing and consolidation of the concrete. Small temporary openings shall be provided at the bottom of the form work to columns, walls and deep beams to permit the cleaning out of debris and observations immediately before concrete is deposit.

n. Form ties shall be constructed so that the ends or end fasteners can be removed without causing appreciable spalling at the faces of the concrete. After the ends or end fasteners of form ties have been removed, the embedded portion of the ties shall terminate not less than twice the diameter or twice the minimum dimension of the tie from the formed faces of concrete to be .permanently exposed to view except that in no case shall this distance be less than 3/4" (19 mm) when the formed Face of the concrete is not to be permanently exposed to view, form tie may be cut off flush with the formed surfaces. Through bolts shall be permitted provided that they are greased to allow for easy withdrawal and the holes subsequently made good. Through bolts are not to be used on water-retaining structures.

o. At construction joints, contact surface of the form sheathing for flush surfaces exposed to view shall overlap the hardened concrete in the previous placement by not more than 1" (25 mm). The forms shall be held against the hardened concrete to prevent offsets or loss of mortar at the construction joint and to maintain a true surface.

p. Runways or planks for moving labor and equipment shall be provided with struts or legs and shall be supported directly on the formwork or structural member without resting on the reinforcing steel.

q. All surfaces of the embedded items shall be cleaned and any accumulated mortar or grout from previous concreting and of all other foreign material is removed before concrete is placed in them.

r. Board forms having joints opened by shrinkage of the wood shall be swelled until closed by wetting before concrete is placed. Plywood and other wood surface not subject to shrinkage shall be sealed against absorption of moisture from the concrete either by (1) a field applied, approved form oil or sealer, or (2) a factory applied non- absorptive liner. When forms are coated to prevent bond with concrete, it shall be done prior to placing of the reinforcing steel. Care shall be taken that such approved coating is kept out of contact with the reinforcement. Where as-cast finishes are required, materials, which will impart a stain to the concrete shall not be applied to the form surfaces. Where the finished surface is required to be painted, the material applied to form surface shall be compatible with the type of paint to be used.

s. In normal circumstances generally where temperatures are above 68F (20C) where ordinary cement is used, forms may be struck after expiry of the following periods.

- Walls, columns and vertical sides of beams 48 hours
- Slabs 14 days
- Beams soffits 14 days
- Removal of shores or props to slabs:

    1. Spanning over 14 ft (4 meters) 21 days

    Removal of shores or props of beams:

    1. Spanning upto 20 ft. (6 meters) 18 days
    2. Spanning over 20 ft. (6 meters) 25 days

For rapid hardening cement 1/2 of the above period will be sufficient in all cases except vertical sides of slabs, beams and columns which should he retained for a minimum of 24 hours.

t. Proper allowance shall be made for the decrease in rate of hardening of concrete in cold weather and the minimum periods must be increased when the mean daily temperature is below 68F, (20C).

u. When repair of surface defects or Finishing is required at an early age forms shall be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations.

v. Top forms on sloping surfaces of concrete shall be removed as soon as the concrete has attained sufficient stiffness to prevent sagging. Any needed repairs or the treatment required on such sloping surfaces shall be performed at once and followed by the specified curing.

w. All form work shall be removed without such shock or vibration as would damage the reinforced concrete.

x. When re-shoring or re-propping is permitted or required, the operations shall be planned in advance and shall be subject to approval. While re-shoring is underway no live load shall be permitted on the new construction. In no case during re-shoring shall concrete in beams, slab, columns or any other structural member be subject to combined dead and live loads in excess of the load permitted by Project Manager for the developed concrete strength at the time of re-shoring. Re-shores shall be placed simultaneously with stripping operations are but in no case later than the end of working day on which stripping occurs.

Re-shores shall be tightened to curry their required loads without over stressing the concrete. Re-shores shall remain in place at least until representative tests of the concrete being supported have reached strength/time specified in 6.1.s.

y. Floors supporting props or shores under newly placed concrete shall have their original supporting props or shores left in place or shall be re-shored. The re-shoring system shall have a capacity sufficient to resist the anticipated loads and in all cases have a capacity equal to at least one hall of capacity, of the shoring system above. The re-shores shall be located directly under a shore position above unless other locations arc permitted.

The re-shoring or re-propping shall extend over a sufficient number of storeys to distribute the weight of newly placed concrete, forms, and construction live loads in such a manner that the design superimposed load of the floors supporting shores or props are not exceeded.

No loads, other than those permitted by the Project Manager in connection with the actual work in hand, shall be allowed on suspended floors until 28 days after concreting where ordinary Portland cement is used and 14 days when rapid hardening Portland cement is used.

z. It is required to give forms for reinforced concrete an upward camber to ensure that the beams or slabs including cantilever slabs do not have a sag when they have taken up their deflection. Camber, unless indicated otherwise on drawings, should be about 1/240 for supported beams and slabs and 1/180 for cantilevers.

11. ACCEPTANCE OF STRUCTURE

11.1 General:

a. Completed concrete work which meets all applicable requirements will be accepted subject to the other terms of the CONTRACT Documents.

b. Completed concrete work which fails to meet one or more requirements and which has been repaired to bring it into compliance will be accepted subject to the other terms of the CONTRACT Documents.

c. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected as provided in these Specifications or in the CONTRACT Documents. In this event, modifications complies with the requirements.

11.2 Dimensional Tolerances;

a. Formed surfaces resulting in concrete outlines smaller than permitted by the tolerances of Section 10 considered potentially deficient in strength and subject to the provisions of Section 11.4.

b. Formed surfaces resulting in concrete outlines larger than permitted by the tolerances of Section 10 may be rejected and the excess material shall be subject to removal. If removal of the excess material is permitted, it shall be accomplished in such a manner as to maintain the strength of the section and to meet all other applicable requirements of function and

appearance. Permission is required if excess material is to removed in accordance with this section.

11.3 Appearances:

a. Architectural concrete with surface defects exceeding the specified limitations shall be removed in accordance with this Section.

b. Concrete members cast in the wrong location may be rejected if the strength, appearance or function of the structure is adversely effected or misplaced items interfere with other construction.

c. Inaccurately formed concrete surfaces exceeding the limits of Section 6 & of Section 10 and which are exposed to view, may be rejected and shall be repaired or removed and replaced if required.

d. Other concrete exposed to view with defects which adversely affect the appearance of the specified finish may be repaired only by approved methods.

e. Concrete not exposed to view, but of defective appearance, may be accepted at the discretion of the Project Manager .

11.4 Strength of Structure:

a. The strength of structure in place will be considered potentially deficient if it fails to comply with any requirements' which control the strength of the structure, including but not necessarily limited to the following conditions:

- Concrete strength requirements not considered to be satisfied in accordance with Section 7.

- Reinforcing steel size, quantity, strength, position or arrangement variance with the requirements of Section 4.4 & 6.2 of the CONTRACT Documents.

- Concrete which differs from the required dimensions or location in such a manner as to reduce the strength.

- Curing less than that specified.

- Inadequate protection of concrete from extreme temperature during the early stages of hardening and strength development.

- Mechanical injury, construction fires, accidents or premature removal of form work likely to result in deficient strength.

- Poor workmanship likely to result insufficient strength

b. Structural analysis and/or additional testing may be required when the strength of the structure is considered potentially deficient.

c. Core tests may be required when the strength of the structure is considered potentially deficient.

d. If core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be required and their results evaluated in accordance with ACI Standard 318.

e. Concrete work judged inadequate by structural analysis or by results of a load test shall be reinforced with additional construction, if so directed by Project Manager or shall be replaced, at the CONTRACTOR'S expense.

f. The CONTRACTOR shall pay all costs incurred in providing the additional testing arid/or analysis required by this Section,

g. THE EMPLOYER will pay all costs of additional testing and / or analysis which is made at his request and which is not required by specifications, or the CONTRACT Documents.

12. METHODS OF MEASUREMENT OF CONCRETE WORKS

12.1 General;

a. Unless otherwise specifically stated in the Bill of Quantities, or herein, all items shall be deemed to be inclusive of, but not limited to, the following:

i. Labor/plant and all costs in connection therewith.
ii. Materials, goods and all costs in connection therewith, e.g. conveyance, delivery, unloading, storing, returning, packing, handling, hoisting, lowering.
iii. All fixtures and all costs in connection therewith for precast works.
iv. Fitting and fixing materials and goods in position.
v. Waste of materials, and Square cutting.
vi. Mixing, transporting, hoisting, placing in from at any level, compacting through vibration &, curing etc. complete including the cost of form work & its removal (but excluding cost of reinforcement).
vii. Establishment charges, overhead charges and profit.
viii. All other expenses, charges and taxes specified in Conditions of CONTRACT.

b. Works shall be measured net as fixed in position as per drawings and instructions of Project Manager . Each measurement shall be taken to the nearest 1/2" (12,0 mm). This rule shall not apply to any dimensions stated in the descriptions.

12.2 Concrete Measurement;

a. Concrete shall be measured as executed but no deduction shall be made to the following:

- Volume of any steel embedded in the concrete.

- Volume occupied by water pipes, conduits etc., not exceeding 4 square inch (2500 sq. mm) each in cross-sectional area.

- Voids not exceeding 1 square foot in work given in square feet and 0.1 sq m in work given in sq meters. If any void exceeds above limit total void shall be deducted.

- Voids not exceeding 1 cubic foot in work given in cubic feet. 0.03 cubic meter in work given in cubic meter. If any void exceeds above limit, unit total void shall be deducted.

b. Voids, which are not to be deducted as per Section 12.2.a above, refer only to openings or vents which are wholly within the boundaries of measured areas. Openings or vents which are at the boundaries of measured areas shall always be subject to deduction irrespective of size.

c. Junctions between straight and curved works shall in all cases be deemed to be included with the work in which they occur.

d. Concrete work shall be classified and measured separately as follows unless otherwise described elsewhere:-

- Buildings, foundation beams, foundation slabs, footings, bases of columns, machine foundations, mass concrete etc., in cubic feet (Cubic meter).

- Floor slabs on ground with floor beams in cubic feet (Cubic meter).

- Walls in foundations, plinth and superstructure in cubic feet (Cubic meter) stating thickness,

- Columns, piers, pilasters, pillars etc., in cubic feet (Cubic meter).

- Lintels, beams and brackets in cubic feet (Cubic meter).

- Suspended floors, roofs and stair landings in square feel (sq. Metre) stating thickness.

- Stairs (including landing) in cubic feet (Cubic meter).

- Railings in cubic feet (Cubic meter), square feet (Sq. meter), or linear feet (meter) stating description.

- Parapets, purdees and the like in cubic feet (Cubic Meter) stating thickness.

- Jali, blocks in square feet (Sq. Meter) stating thickness & description.

- Precast concrete items shall each be enumerated except if otherwise shown in the Bill of Quantities, separately stating the description.

e. Measurement of walls shall be taken between attached columns, piers or pilasters. The thickness of attached columns, piers or pilasters shall be taken as the combined thickness of the wall and the columns, piers or pilasters. Attached or isolated columns, piers, pilasters and the like (except where caused by openings) having a length on plan not exceeding four times the thickness shall be classified as columns. Those having a length over four times the thickness and caused by openings in walls shall be classified as walls.

Columns shall be measured from the top of footings/beams or floor surfaces to the under side of beams or slabs as the case may be. Where the width of the beams is less than the width of columns, the extra width at the junction shall be included in the beam.

The depth of the beams shall be measured from bottom of the slab to the bottom of the beams, except in case of inverted beams where it shall be measured from top of slab to the top of beam. The cross section below or above the slab.

12.3 Formwork Measurement:

a. Formwork if separate and extra payment is specifically stated in the Bill of Quantities shall be measured in square feet (Sq. m) as the actual surface of the finished structure which required to be supported during the deposition of the concrete, including the upper surfaces to the work sloping more than 15 degree from the horizontal. No allowance shall be made for overlaps and passing at angles and no deduction shall be made for the following:-

- Voids not exceeding ten square feet(1 Sq. m).
- Intersections of main beams with walls or columns.
- Intersections of secondary beams with main beams.

b. Form work shall be deemed to be inclusive of, but not limited to items detailed in section 12.1 and the following:-

- Batten, struts, reversed cut strings, bolting, oiling, wedging, easing, striking, removing and making good exposed faces of concrete after removal of form work. Also yokes, wales sheathing, jack rods, jacks, working platforms and finishers, scaffolds, etc.

c. Forming chamfers not exceeding 2" (50mm) wide and forming splayed internal angles not exceeding 1/2" (12.0 mm) wide shall not be for extra.

d. Temporary stop ends for constructed joints shall not he measured and for.

e. Classification of formwork (if separate and extra payment is specifically stated in the Bill of Quantities) shall be as follows:-

- To horizontal or sloping soffits of suspended slabs, floors, roofs, staircases, landings and the like.

- To sloping upper surfaces of suspended slabs, floors, roofs and the like where more than 15 degree from horizontal.

- To vertical or battering sides of foundations, foundation beams and slabs, ground beams, machine foundations and the like.

- To vertical or battering sides of walls, solid balustrades and the like.

- To vertical or battering sides.

- To vertical or battering sides of stanchion casings, columns, piers, plasters and the like.

- To sides and soffits of openings in walls, recesses in walls, projecting panels on walls and the like.

- To sides and soffits of horizontal or sloping beam casings, beams, brackets, lintels, staircase, strings and the like.

- To sloping upper surfaces of beam casings, beams, brackets, lintels, staircase-strings and the like where more than 15 degrees from horizontal.

- To edges of beds, roads, footpaths, paving and the like.

- To edges of suspended slabs, floors, roofs, landing and the like.

- To risers of steps and staircases.

- To sides of kerbs, upstands and the like.

f. Form work to throats, grooves, chasess rebates, chamfers over 2" wide (50 mm) splayed internal angles over 1/2" wide (12.5 mm) moldings and the like shall each be measured separately in linear feet stating the size.

12.4 Reinforcement Measurement:

a. The rate tendered for any type of reinforcement by the CONTRACTOR shall also be inclusive of the cost of binding wire wastages, and the cost of concrete, metal or plastic chairs and spacers or hungers, etc.

b. All reinforcement shall be provided in length shown in drawings and as per Specifications.

Should the CONTRACTOR provide lengths of reinforcement which are greater than shown on the Drawings no payment of extra length shall be made. Overlaps, unless clearly shown in working Drawings, shall not he allowed and measured.

c. The CONTRACTOR shall be paid for reinforcement by weight computed from Table-2 and from linear measurements of reinforcements actually used at SITE as per the Drawings, Specifications and instructions of Project Manager . No payment shall be made for steel chairs or wastage. CONTRACTOR shall not claim for the difference in the actual weights of bars and their standard weights given in Table -2.

TABLE - 2

Nominal Bar Diameter (lnches)	Bar Number	Weight lbs/ft
¼”	-	0.167
3/8"	#3	0.376
½"	#4	0.668
½”	#5	1.043
¾”	#6	1.502
7/8"	#7	2.044
1".	#8	2.670
1-1/8"	#9	3.400
1-1/4"	#10	4.303
1-3/8"	#11	5.313
1-3/4"	#14	7.650
2-1/4"	#18	13.600

(mm)	(kg/m)
8	0.395
10	0.616
12	0.887
16	1,576
20	2.463
22	2.980
25	3.849
28	4.828
32	6.306
36	7.981

To the nearest 1/8

Chapter-5
Brick Masonry

1.0 SCOPE OF WORK

The work covered by this section of the specifications, consist of furnishing all plant, labour, equipment, applications and materials and in performing all operations in connection with the supply and installation of first class brick masonry including wall ties, anchors, damp-proof courses and expansion joints, complete in strict accordance with this section of the specifications and the applicable drawings and subject to the terms and conditions of the contract.

2.0 APPLICABLE STANDARDS

Latest editions of Pakistani, British and ASTM Standards are relevant to these specifications where applicable.

3.0 MATERIALS

3.1 General

3.1.1 All Portland cement for mortar shall be furnished by the Contractor and shall conform to the applicable requirements specified in the section "Plain and Reinforced Concrete".

3.1.2 All sand for mortar shall be furnished by the Contractor and shall conform to the applicable requirements for sand specified in the section "Plain and Reinforced concrete".

3.1.3 All water used in the manufacture of bricks and in the preparation of mortar shall be free from objectionable quantities of silt, organic matter, alkali, salts and other impurities, and will be tested and approved by the Engineer.

4.0 MORTAR

4.1 Mortar for all brick masonry, expected where otherwise directed by the Engineer, shall consist of One part Portland Cement to six parts of damp loose mortar sand by volume and sufficient water to produce the proper consistency for the intended use. Where directed by the Engineer for increased workability, hydrated lime putty, approved by the Engineer, shall be added to the mortar but shall not exceed 25%, by volume of the dry cement.

4.2 Methods and equipment used for mixing mortar shall be such as that will accurately determine and control the amount of each separate ingredient entering into the mortar and shall be subject to the approval of the Engineer. Mortar shall be mixed only in sufficient quantities for immediate use and all mortar not used within 30 minutes after addition of the water to the mix shall be wasted. Re-tempering of mortar will not be allowed. The mixers shall be thoroughly cleaned and washed at the end of each day's work.

5.0 BRICK

5.1 All bricks shall be of first class quality made from good brick earth, free from saline deposits and shall be sand moulded. They shall be thoroughly burnt without being vitrified, shall be regular, uniform in shape and size with sharp and square edges parallel faces and of deep red or copper colour. First class bricks shall be homogeneous in lexture and emit a clear ringing sound when struck, and shall be free from flaws, cracks, chips, stones and nodules of lime. First class brick in an oven dried condition shall not absorb more than 1/5 of its weight of water immersed one hour in water of 21 to 27 degrees centigrade and shall show no signs of efflorescence on subsequent drying. The average compressive strength of five representative first class than 15 N/mm.sq. for any individual brick.

5.2 All bricks shall be manufactured by the Trench Kiln method or other standard methods approved by the Engineer. The earth used in manufacturing bricks shall be carefully selected and shall be free from objectionable quantities of lime, gravel coarse sand, roots, or other organic matter salts shall not exceed 0.3 % and calcium carbonate shall not exceed 2.0% .

5.3 The moulds used in the manufacture of bricks shall be thoroughly sanded before each use and shall be sufficiently larger than the size of the bricks being manufactured to allow for shrinkage in drying and burning. Over size irregular and worn moulds shall be destroyed . Each finished brick for brick masonry shall be 9" by 4.56" by 3" in size and weigh between 3.2 to 4.2 Kilograms. All bricks shall have a "Frog" 1/4" deep on one face.

6.0 PLACING

6.1 The methods and equipment used for transporting the bricks and mortar shall be such as that it will not damage the brick nor delay the use of mixed mortar. Brick shall not be placed during rains sufficiently heavy or prolonged to wash the mortar from the brick. Mortar already spread which becomes diluted by rain shall be removed and replaced before continuing with the work. All brick to be used in brick masonry shall be moistened with water from three to four hours before they are used by a method which will ensure that each is thoroughly and uniformly wetted. All bricks shall be free from water adhering to their surface when they are placed in the brick masonry.

6.2 Bricks shall be laid "Frog" upward with mortar joints and in English bond as shown on the Drawings or as directed by the Engineer. Both bed and vertical joints shall be 1/4" in thickness completely filled with cement mortar as specified herein, and each brick shall be bedded by firmly tapping with the handle of the trowel. All horizontal joints shall be parallel and all vertical joints in alternate courses shall be directly over one another. Excess mortar at the outer edges shall be removed and joints drawn straight with the edge of a trowel and a straight edge. All anchors and similar work required to be embedded in the brick masonry shall be installed as the work progresses. At the completion of the work all holes or defective mortar joints shall be cut out and re-pointed.

6.3 The exterior faces of the walls shall be finished by striking the joints as the work proceeds. The joints shall be struck by raking the green mortar after the brick work has been laid and finishing the joint with a pointing tool. Horizontal joints

shall be struck to form a weathered joints and vertical joints shall be struck with a V notch. Care shall be taken that the striking tools do not develop a cutting edge as the object of striking the joint is to compress the mortar into the joints.

7.0 CURING AND REPAIR

7.1 All brick masonry shall be water cured and shall be kept wet for atleast seven days by an approved method which will keep all surfaces to be cured continuously wet. Water used for curing shall meet the requirements of these specifications for water used in the manufacture of bricks.

7.2 If, after the completion of any brick masonry work, the brick is not in alignment or level , or does not conform to the lines and grades shown on the Drawings, or shows a defective surface, it shall be removed and replaced by the Contractor at his expense unless the Engineer grants permission, in writing to patch or replaced the defective area.

8.0 SCAFFOLDING

Contractor shall provide safe scaffolding of adequate strength for use of workmen at all levels and heights at his won expenses. Scaffolding which is unsafe in the opinion of the Engineer shall not be used until it has been strengthened and made safe for use of workmen. Cost of scaffolding etc., shall be included by the Contractor in the unit rate for masonry items.

Damaged, masonry from scaffolding or from any other objection shall be repaired by the Contractor at his own cost.

9.0 TOLERANCES

The brick work shall be erected plumb and true to line at level with the maximum variation in any storey height many length of wall being One millimeter in One meter. The maximum tolerance in the length, height or width of any single masonry unit shall be ±1/8"/± 3mm.

10.0 MEASUREMENT AND PAYMENT

10.1 General

Except otherwise specified herein or else where in the Contract documents, on measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities.

10.1.1 Cutting and Chiselling of masonry wherever required.

10.1.2 Cement sand mortar used in laying bricks including wastage.

10.1.3 Curing & repairing the masonry work.

10.1.4 All joint reinforcing bars, reinforcing anchor bars and dovertail anchors.

10.2 Measurement.

Measurement of acceptable completed works of brick masonry will be made on the basis of number of cu.ft/cubic meter provided & installed in position as shown on the drawing or as directed by the Engineer.

10.3 Payment.

Payment will be made for acceptable measured quantity of brick masonry on the basis of unit rate per cu.ft/cubic meter quoted in the Bill of Quantities & shall consistute full compensation for all the works related to the items.

Chapter-6
Marble Work

1.0 SCOPE OF WORK

The work covered under this section of specifications, consist of providing all material, labour, plant, equipment, appliances and performing all operations required for installation and providing of marble stone slab/tile including finishing as shown on drawings in interior and exterior floors and wall cladding, counter tops, vanity tops, division panels and the like complete in all respect strictly accordance with this section of the specifications and the applicable drawings.

2.0 SUBMITTALS

The Contractor shall submit manufacturers specifications and other product data for each type marble stone fixtures required including instructions for handling, storage, installation and production.
Shop drawings shall be submitted showing sizes, dimensions, sections and profiles of slab and tile units, arrangement and provisions for jointing, anchoring, fastening and supports and other necessary fixing details. Indicate locations, layouts and pattern arrangements for stone of each type and colour.
Submit three range samples 12"x12"/300mm x 300mm in size of each type of stone showing colour guide, finishing and texture for approval of the Project Manager including samples of fixtures for terrazzo.

3.0 DELIVERY, STORAGE AND HANDLING

Materials shall be protected from damage during loading, shipment, delivery and storage. Non-standing materials for blocking and packing shall be used. Stack marble and Terrazzo units at Site in accordance with manufacturer's recommendations and as required to prevent staining, scratching, etching or breakage.

4.0 MATERIALS

4.1 General

Obtain each marble stone type from a single quarry and ensure consistent colour range and texture throughout the work.

Providing continuous slabs or tiles for continuous wall areas, intersecting planes, and counter tops to provide continuous matching units.

Provide stone of type, colour and finish for each area of use as approved by the Project Manager.

Provide stone of thickness shown. Saw-cut hack surfaces which will be concealed in finished work.

Irregular shaped units, staircase units and skirting base units to profiles required, with arises sharp and true and matched at joints, polish exposed edges.

4.2 Type

All stone type are to be selected and approved by the Project Manager for quality, colour and texture.

a) Marble: Lesbella marble of high class in floor and dado.
b) Marble (white Malagori on walls dado skirting)
c) Marble (white Karara in skirting)

4.3 Beds and Backings

Where applicable standard cementation screed and mortar beds and backup mixed and proportioned by volume shall be as follows:

Portland Cement White or Grey	1 Pan.
Sand	4 Parts.

4.4 Adhesives, Grouts and Sealants

Where specified on the drawing or as directed by the Project Manager proprietary adhesives, joint grouts and sealant; suitable types as required and recommended for specific application; colour match joint grout and sealant to colour of stone shall be used.

5.0 EXECUTION

5.1 Paving. Flooring Stair

Apply cement slurry coat surfaces of concrete substrate immediately prior to placing setting bed. Limit area of application to avoid premature drying out.

Install setting bed to thickness required and set stone units before initial set occurs. Apply a thin layer of real cement paste to bottom of each unit: set. lamp, and level units immediately. Set units in pattern required, with uniform joint widths.

Point joints as soon as possible after initial set. Force grout into joints, strike flush and toot slightly concave.

Remove mortar and grout from surface while still moist and as the work progresses.

Do not permit traffic on finished surface during setting and for minimum 24 hours after final pointing of joints.

52 Wall Cladding

Walls cladding shall be executed in accordance with CP. 298 and the approved shop drawings and as per direction of the Project Manager . Installation shall be true to plumb and perfectly in the line and plane. Projecting edges anywhere in the works shall not be allowed.

5.3 Marble arches, panels with jali

Marble stone of the specified size shall be installed to walls on 1:4 rough plaster surface. For joints, colour matching grout and sealant to colour of stone shall be used. In washed Terrazzo white cement and marble chips in 1:2 ratio will be used.

5.4 Marble Vanity Tops

Marble vanity tops of the specified size shall be installed in areas shown on drawings with M.S angle framing and fixing accessories in accordance with approved shop drawing. Joints shall be grouted with matching colour or with matching colour sealant.

5.5 Marble In Teller's Counter

Marble stone of specified sizes as shown on drawings shall he installed in the walls of the counter and fixed with approved expansion bolt. The marble stone cladding work shall conform to the requirements specified in clause 5.2 herein before.

On top of Teller's counter Marble stone shall be fixed as specified in clause 5.1 here before.

5.6 Repair and Cleaning

Remove and replace stone units which are broken, chipped, stained or otherwise damaged. Where directed, remove and replace units which do not match adjoining stone work or is not in line and levels as shown on drawings. Provide new matching units, install and point joints to eliminate evidence of replacement. Repoint defective and unsatisfactory joints to provide neat, uniform appearance.

5.7 Protection

Provide covers, boards, supports and all other necessary materials to protect finished work from collapse, deterioration, discoloration or damage during installation and until contract completion.

5.8 Polishing

The finished surface shall be provided with two applications of approved wax polish.

6.0 MEASUREMENT AND PAYMENT

6.1 General

Except otherwise specified herein or else where in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

6.1.1 Finishing washing, polishing , repair, cleaning and protection of marble and granite tiles in position.
6.1.2 Proprietary adhesives, joint grouts and sealant for fixing marble and granite tiles where specified on the drawings or directed by the Project Manager .
6.1.3 Cement concrete setting beds and backings for marble and granite tiles.
6.1.4 Preparation of concrete substrate for laying marble tiles.
6.1.5 Expansion bolts, anchors and accessories in granite wall cladding.
6.1.6 M.S. angle framing and fixing accessories for marble vanity lops.

6.2 Measurement

Measurement of acceptably completed works of marble tile in floor, skirting Head & riser will be made on the basis of net actual area in Sft./square meter of marble tiles laid in position as shown on the drawings or as directed by the Project Manager .

6.3 Payment

Payment will be made for acceptable measured quantity of marble tile in floor, tread & riser on the basis of unit rate per Sft./square meter quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the item. No separate payment will be made for carborundum insert in marble tile treads.

Chapter-7
Terrazzo Work

1.0 SCOPE OF WORK

The work covered by this section of the specifications, consist of furnishing all plant, labour, equipment, appliances and materials and in performing all operations complete in strict accordance with this section of the specifications and the applicable drawings and subject to the terms and conditions of the contract. The work under the section includes the followings:-

a) Precast terrazzo tiles flooring
b) In situ terrazzo flooring
c) Terrazzo Dado and Skirting
d) Terrazzo on stairs
e) Terrazzo finished precast partitions for Toilets

2.0 APPLICABLE STANDARDS

Unless otherwise specified, terrazzo work shall be in conformity with British standard Code of Practice C.P. 204 In Situ Flooring Part 1, 'General' and Part 3. "Terrazzo Flooring" as applicable to the work shown on the drawings and specified in the Bill of Quantifies.

3.0 MATERIALS

3.1 Cement. Sand, Aggregate and Water for Concrete shall conform to specification for "Plain and Reinforced Concrete".

3.2 Marble Chips shall be crushed marble and shall be best quality white or coloured sound and hard local marble chips approved by the Project Manager and of the as mentioned in the Bill of Quantities or as required by the Project Manager.

3.3 Dividing Strips shall be glass, brass or marble strips 4-5 mm thick and 1-1/2" wide or as specified in the Bill of Quantities.

3.4 Angle Clips for precast toilet partitions shall be chromium plated steel or stainless steel clips as shown on drawings.

3.5 Bolts of precast toilet partitions shall be 5/16" inch bars bolts chrome-plated, with acron heads, fitted to wall anchors.

3.6 Terrazzo Tiles Terrazzo tiles shall be first grade, mechanically compressed type conforming to PS-531. Tiles shall be 12"x12"x0.88" / 30.0x30.0x2.2cm with a toping of 0.4" or 10.00mm thickness composed of 1:2 cement & marble chips. The base being 1:3 cement mortar. The colour, quality and size of chips shall be as per Project Manager's approval.

Cleaning Compound The Compound used for all cleaning of terrazzo shall be an approved neutral chemical cleaner free from acid and alkali or any other material that will affect the colour or other wise damage the Terrazzo and shall not affect the conductivity of terrazzo floors.

4.0 SAMPLES

All materials used for Terrazzo and marble work as well as samples of terrazzo floor and marble work shall be submitted to the Project Manager and his approval obtained. Same materials should also be tested and this shall be got done by the Contractor at his own expense from a Laboratory approved by the Project Manager.

5.0 EXECUTION

5.1 Insitu Terrazzo Flooring

The floor shall consist of a wearing surface to consistency and net thickness as specified in Bill of Quantities, laid over 1:2:4 under bedding concrete of the specified thickness. The net uniform thickness specified for wearing surface shall be that obtained after grinding and polishing. The 1:2:4 concrete shall be mixed and laid in the manner specified for cement concrete floor using a minimum quantity of water.

The concrete shall be leveled with a trowel and straight edge consolidated and finished with steel trowels to an even but rough surfaces. The top layer of cement and marble chips mixed in the proportion of 1:2 (1 cement and 2 marble chips) shall be laid over it within 12 hours. The cement and marble chips must be mixed dry in such quantities that are sufficient for a unit area of one specified shade. Water shall be added to only such quantities that can be mixed thoroughly and consumed in less than 30 minutes, the quantity of water being the minimum for workability.

Mixing must to be done on water tight platform and any mix not used within 30 minutes shall be discarded and removed from the Site. A layer of cement and marble chipping mixture should be well troweled into the surface of the base concrete before filling to the top level of the screeds. The layer should be well compacted and all voids shall be filled in. A layer of neat cement, of the specified colour shall then be well-troweled into a plain smooth surface. Floors shall be laid in panels of sizes as shown on drawings and in Bill of Quantities or as directed by the Project Manager. Dividing strips, as specified shall be provided and fixed to exact levels making an allowance for grinding.

Three days after laying, the top layer must be evenly and smoothly machine ground with Carborundum blocks of coarse, medium and fine grades so as to ensure that all marble chipping are evenly exposed all over the surface.

If marble chips are not evenly exposed the Contractor shall pull down the sin face and relay it at his own cost. The surface after grinding shall be left undisturbed and cured for 2 to 3 weeks after which it shall be cleaned of dirt and dust gently by rubbing with pumise stone or washing soda in sufficient water. Three days after the surface has been cleaned, it shall be rubbed hard with 1:10 solution of oxalic acid using fell. The surface shall then be cleaned and washed with plenty of water. After the surface has dried a final gloss shall be given by polishing surface to the satisfaction of the Project Manager.

5.2 Terrazzo Dado & Skirting

The marble chips and cement shall conform to specifications for floor. Mixing shall be done in the same manner and proportion. The plastered surface over which the dado/skirting is to be applied shall be well roughened and watered, cement mortal of specified ratio shall then be plastered over this well roughened surface to indicated thickness. Before the base course had set, the layer of terrazzo mixture of the specifications for flooring shall be well troweled into the surface of the base to a thickness which after, grinding shall result in the finished thickness as per Bill of Quantities. A layer of neat cement of the specified colour shall then he well troweled into the surface leaving a plain smooth surface. After 24 hours the Contractor shall start finishing as for floors specified above, Terrazzo skirting shall be provided around all terrazzo floors unless otherwise shown. Skirting and dado shall be straight, level and in plumb. Intersections at floors shall be straight and flush. They shall be with 1/4 radius coved at floor unless otherwise shown.

5.3 Terrazzo on Stairs

The stair risers and treads shall be finished according to exact sizes including the terrazzo making allowance for grinding of terrazzo.

5.4 Terrazzo Finished Precast Partitions of Urinals

Partitions walls of urinals shall be precast R.C.C. slabs finished will) l/'l" thick polished terrazzo on both faces. The finished thickness of these walls shall be 3" or as shown on drawings and BOQ R.C.C. slab shall conform to the specification for "Concrete" and terrazzo as per this section. Fixing of these partitions of floor walls. etc. shall be as directed by the Project Manager and as shown on Drawings.

5.5 Terrazzo Tile Works

The terrazzo tiles will be laid to the required levels and grades over a bedding of cement mortar comprising of 1 part of cement and 3 parts of sand by volume. I thickness of cement sand bedding screed shall be as per Bill of Quantities.

The curing period of the bedding shall be as directed by the Project Manager. As large an area of bedding shall be spread at one time as can be covered with tiles before the mortar has set. Surplus mortar shall be removed. The thickness of bedding in any space shall not be less than 1/2" / 12.5mm.

Floor and wall surfaces to receive the tiles shall be thoroughly cleaned of all dirt, dust, oil and other objectionable matters. Tiles shall be laid out from the Centre line of each space in an outward direction and the pattern should be made symmetrical with a minimum number of cut tiles. Joints between the tiles shall be of uniform width. Tiles shall be cut with a suitable cutting tool and rough edges shall be nibbed smooth. Tiles shall be laid to the straight edges.

After seven days the terrazzo tile floors shall be machine ground to a true even surface using various grades of abrasive stones as required and directed by the Project Manager. After the first grinding the floor shall be grouted with the same colour composition as used for its manufacture. The grout shall be of the consistency of thick cream and shall be brushed over the floor to fill in the joints and after 72 hours the grouting coat shall be removed b y grinding till a smooth and even surface is obtained. Area and portion of the floor inaccessible for the grinding machine shall be ground and rubbed by hand. The final gloss shall be given by polishing the surface to the satisfaction of the Project Manager.

The tiled floor shall be kept wet for at least 72 hours and no one should be allowed to walk on the tiles during that period.

6.0 MEASUREMENTS AND PAYMENTS

6.1 General

Except otherwise specified herein or else where in the contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

6.1.1 Grinding, washing polishing and finishing of Terrazzo work.
6.1.2 Under bedding and screening.
6.1.3 Preparation of concrete surface for Terrazzo works.
6.1.4 Cement concrete base.

6.2 Measurement

Measurement of acceptable completed works of Terrazzo Flooring , Dado, Skirting. Treads, Risers etc., will be made on the basis of number of sq. ft. / square meter provided & installed in position as shown on the drawing or as directed by the Project Manager.

6.3 Payment

Payment will be made for acceptable measured quantify of Terrazzo Work on the basis of unit rates per.sq.ft / square meter quoted in the Bill of Quantities & shall constitute full compensation for all the works related to the items.

Chapter-8
Ceramic Tiles

1.0 GENERAL

1.1 Scope

The work covered by this section consists of furnishing all plants, labour, equipment appliances and materials and performing all operations in connection with installation of Ceramic tile walls, floor, base of KITCHEN ., include cement mortar screeded beds and backings.

1.2 Reference Standards

Tile Council of America:

TCA 137.1 * Recommended Standard Specifications for Ceramic Tile.

British Standards Institution:

BS	1281 *	Glazed Ceramic Tiles for Internal Walls.
BS	1286 *	Clay Tiles for floors.
BS	5385 *	Code of Practice for wall tiling.
BS	202 *	Tile Flooring and slab flooring.

1.3 Submittals

Samples:

Submit two finished samples of ceramic wall and floor tile, each approximately 300mm square; indicating the pattern and colour selected by the Project Manager, with grouted joints.

2.0 PRODUCTS

2.1 Tiles and Accessories

Manufacturers acceptable or equivalent contingent upon product compliance with the specifications.

H & R Johaon - Richards Ltd,
Tunstall,
Stoke-on-Trent ST6 4 JK,
United Kingdom.
Tel: 0782-85611
Tlx:36146

American Olean Tile Co,
Cliesco Company,'
P.O.Box 533,
346 Maple Avenue,
Westburry,
New York 11590
Tel: 516-333-7050
Tlx: 96-7757

Floor Tiles

Ceramic Floor Tile unglazed; natural clay; 0 Permit 0.5 percent water absorption; as shown on drawing cushioned edges; non-slip surface where detailed 01 scheduled: colours to be selected by the Project Manager.

Wall Tiles

Ceramic wall Tile; glazed; natural clay; 0 Percent to 0.5 Percent water absorption: as shown on drawing cushioned edges; colours to be selected by the Project Manager supply with matching cove base.

Swimming Pool Tiles

Proprietary manufactured glazed ceramics tiles specifically designed for use in Toilets, Kitchen, size as on drawings colour to be selected by the Project Manager, including contrasting colour tiles for lane marking and turning target patterns, pool edge profiles and depth making tiles as detailed or required:

2.2 Beds and Backings

Standard cement mortar: screeded beds and backings for tile work; mixed and proportioned by volume, as follows;

Portland Cement.	1 Part.
Sand.	2-1/2 to 4 parts.
Lime.	1/4 part.

Water; Clean, fresh and free of deleterious substances.

2.3 Adhesive and Grout

Proprietary tile adhesives and joint grouts; suitable types as required and recommended by the manufacturer for specific tile work locations.

3.0 MEASUREMENTS AND PAYMENTS

Work under this section shall be measured in square feet of wall and floor area, partition shall be measured on both faces.

The rate for all items of work under this section shall cover the cost of furnishing all materials, labour, scaffolding, laying .curing , finishing, and appliances at Site and performing all operations at any height in accordance with drawings, Bill of Quantities and as specified. The rate shall Include the cost of furnishing and installing metal fixings, providing all assistance to other trades for built in items to the satisfaction of the Project Manager.

Chapter-9
Plaster and Pointing

1.0 SCOPE OF WORK

The work covered by this section of the Specifications consists of furnishing all plant, labour, equipment, appliances, materials and performing all operations in connection with providing and installation of cement plaster complete in strict accordance with this section of the Specifications, applicable drawings and subject to the terms and conditions of the Contract.

The scope of this section of specification is covered with detailed Specifications as laid down herein.

2.0 APPLICABLE STANDARDS

Latest editions of following Pakistani, British & ASTM standards are relevant to these specifications wherever applicable.

2.1 Pakistan Standard

P.S.23 Ordinary Portland cement.

2.2. ISO (International Organization for Standardization).

R.579 Definitions and terminology of cement.

R.579 Method of testing strength of cements compressive and flexural strengths of plastic mortar (Rilem-Cembureau method).

R.680 Chemical analysis of cement-Main constituents of Portland mortar cement.

R.682 Chemical analysis of cements-Determination of sulphur as sulphide.

2.3 ASTM (American Society for Testing and Materials).

C. 144 Aggregate for Masonry Mortar.

C. 631 Bonding Compounds for interior plastering.

2.4 BST (British Standards Institution)

812	Methods for Sampling and Testing of Mineral Aggregates, Sands and Filters.
1199	Sands for External Renderings. Internal plastering with Lime and Portland Cement and floor screeds. .
1369	Metal Lathing (Steel) for Plastering.
5262	External Rendered Finishes.
5492	Internal Plastering.

3.0 GENERAL

3.1 Except as may be otherwise shown surfaces specified, all plaster work, both internal and external, shall be ordinary Portland cement plaster of the required thickness shown on the Drawings.

3.2 Plastering shall not commence until electric conduits, drainage, sanitary pipes, inlets to tanks, brackets, clamps, doors arid window frames and all sorts of inserts and embedded items arc Fixed in position. It shall be the responsibility of the Contractor to make sure that all such work is carried out before starting of plaster work. Chiseling and repairing of cement plaster shall not be permitted without the approval of the Project Manager.

4.0 MATERIALS

4.1 Cement

Cement for plaster shall be Portland Cement either ordinary . rapid hardening 01 sulphate resisting cement as specified complying with P.S.232 01 BS-12 and shall conform to requirement specified in the sections plain and reinforced Concrete.

4.2 Sand

Sand for plaster shall comply with the requirement of BS 812, BS-11 99 and AS 1 M C-144.

It shall comprise natural sand. crushed stone sand or crushed gravel sand. It shall be hard durable, clean and free from adherent coatings such as clay and from any appreciable amount of clay in pellet form. It shall not contain harmful materials to adversely affect the hardening, the strength, the durability or the appearance of the plaster or any materials in contact with it. The quantity of clay, silt and dust shall not exceed 5% by weight for sand or crushed gravel or 10% by weight for crushed stone sand.

The grading of sand for internal plaster work and external rendering shall be within the following limits.

Percentage by weight passing slew sizes:

Sieve Size mm	Internal Cement Plaster work and external rendering W
0.275.00	100
0.09472.34	90-100
0.04771.18	70-100
0.02470.6	40-80
0.01270.3	5-40
0.00670.15	0-10

The grading specified .above shall be suitable for smooth finishing coats, scraped finishes and for pebble-dash or dry-dash for textured surfaces, produced by the treatment of the freshly applied final coat with a tool, the coarser particles shall be removed by screening through a 1/12”/2 mm sieve.

4.3 Water

Water for plaster shall conform to requirements specified in the section for plain and reinforced concrete.

4.4 Additive

Additives for controlling the setting and working characteristics of plaster or for imparting anticorrosion, fungicidal or water proofing properties, shall be added to the plaster strictly in accordance with the particular manufacturer's written instructions. Good quality hair or manila fibre in reasonably well distributed proportion may be to the plaster to assist application and reduce droppings. No additives shall be used except as specified in the Contract Documents.

4.5 All materials and workmanship for plaster, not explained in these specifications shall comply with the requirements of relevant BS-CP 211 and CP-221 as directed by the Project Manager.

5.0 PROPORTIONING AND MIXING

5.1 Measurement of materials by volume shall be by containers of known capacity to maintain consistent proportions. No lumpy or caked material shall be used. Mixing equipment boxes and tools shall be clean. Materials shall be proportioned as specified on the drawings , in the Bill of Quantities or as directed by the Project Manager. Mixing shall be continuous until complete and all ingredients are evenly distributed.

5.2 Only limited water shall be added for proper workability and such quantity of the mortar shall be prepared as that which will be consumed in thirty minutes after preparation. -Preparation of mortar in bulk quantity for use during the entire day or for any other time more than that stipulated above is expressly prohibited. Re-tempering shall not be permitted and all mortar which has begun to stiffen shall be discarded.

5.3 Plaster ingredients shall be thoroughly mixed either by hand on a clean cement concrete platform or by a mechanical mixer, as directed by the Project Manager.

6.0 PREPARATION OF SURFACE TO BE PLASTERED

6.1 Surface to be plastered shall be cleaned to remove all grease, form oil and other surface impurities which will otherwise adversely affect the adhesion of plaster to the surface concerned. The surface of all concrete ceilings, beams and columns shall be lightly hacked by approved means to give the required key for plastering.

6.2 All masonry surfaces to be plastered shall be cleaned to remove all matter which will otherwise adversely affect the adhesion of plaster to the surface concerned. The surface shall be washed with clean water and kept damp for 24 hours before further treatment. The surface thus prepared shall be treated uniformly with cement and sand slurry. The slurry to be used shall be one part cement to one part sand by volume with water added to make a stiff creamy mix. The slurry shall be applied with a stiff brush on surface which has previously been well wetted. The surface so treated shall be left to cure for three days.

7.0 APPLICATION OF PLASTER

7.1 The plaster of a thickness less than the specified thickness shall be rejected. If the plaster is to be more than 1/2" /13mm thick, it shall be done in two coats. The surface of first coat shall be made rough before the second coat is applied. The plaster shall not have wavy surface and shall be perfectly in plumb. The edges and corners shall represent a straight line. The plaster shall be kept wet continuously for at least ten (10) days. No extra payment shall be allowed for jambs, junctions, corners, edges round surfaces or for more than one layer of plaster required due to any unevenness in the work done by the Contractor. The plaster work is to cover all conduits, pipes etc. fixed, in the walls and ceiling. Wherever specified metal lath shall he nailed firmly before plastering is commenced. The plastered surface shall be tested frequently with 9.843'/3 meter straight edge and plumb bob.

7.2 Plaster containing cracks, blisters, pits, discoloration or any defects shall not be acceptable. Any such plaster or loose plaster shall be removed and replaced with plaster in conformity with these specifications. The Contractor shall cut and patch all defective work at his own cost. All damaged plaster shall be patched as directed by the Project Manager. Patching plaster shall match with and shall be finished leveled with adjoining plaster.

8.0 METAL LATH OVER REINFORCED CONCRETE AND MASONRY JOINT

Metal lathing shall be fabricated from sheet steel, and shall be of uniform quality and tree from flaws broken strands, cracks and corrosive pitting, shall he rectangular and true to shape and shall comply with BS-1369.

All lathing shall be galvanized. Where plastering material depends entirely on the lathing for its key, these shall be not less than two complete mesh openings per 1.12"/28 in one direction and the width of the aperture shall not be less than 0.2"/5mm.

Sheet shall be not less than 1.60 Kg. /m^2 when fabricated, using 0.7mm thick steel sheet. Where used on smooth surfaces to form a key it shall be not less than 1.20 Kg /m^2 when fabricated, using 0.02"/0.5mm thick steel sheet. Typing wire shall be 0.048"/1.2mm diameter galvanised annealed iron wire.

Before plastering, wherever block masonry meets with reinforced concrete members 6"/150mm wide continuous strip of expanded metal lath shall be nailed to the masonry and the reinforced concrete member covering the point completely to prevent cracking of the joint.

9.0 BEADS & PROFILES

Angle beads, corner beads, stop beads, architrave beads, depth gauge beads, edging profiles, plaster dividing profiles, interior angle profiles, plaster borders and the like shall all be manufactured from sheet steel and galvanized after fabrication, all beads & profiles shall be perforated at edges to ensure good adhesion of the plaster work. Thickness and dimensions shall suit particular locations and plaster work thickness.

Nails for fixing lathing shall be galvanised and have either clout heads or small flat heads to suit particular locations.

All angle beads, stop beads, architrave beads, depth gauge beads, and the like are to he fixed in accordance with the manufacturer's instructions.

10.0 CLEANING AND PROTECTION

10.1 Rubbish and debris shall be removed as necessary to make way for work of other trades and as directed by the Project Manager. As each room or space is completed all rubbish, debris , scaffolding and tools should be removed to leave the room clean.

10.2 Prior to plastering all aluminium windows and finished metals should be covered by sheet of plastic or tarpaulin to protect damage.

10.3 Protect finished plaster from injury by any source. Contractor shall also protect walls floors and work of other trades from plaster materials.

11.0 TOLERANCES

Surfaces of plaster work shall be finished with a true plane to correct line and level with all angle and corners to a right angle unless otherwise specified.

Maximum permitted tolerances shall not exceed l/8"/3mm in 6.562 ft/2m variation from plumb or level in any exposed line or surface and 0.06"/1.5mm variation between planes of abutting edges or ends.

12.0 POINTING WORK

Joints of masonry work to be pointed shall be properly raked to 1/2" depth, cleaned and wetted.

For struck pointing the mortar shall be filled in the joints flush with masonry with a pointing trowel and then pressed with proper pointing tools to form weathered and struck horizontal and triangular or V-notched vertical joints.

For flush pointing after pressing mortar in the joints these shall be tilled up with mortar and finished level with edges.

After pointing the face of the work shall be cleared of all surplus mortar. No washing shall be done till the pointing has set. All defects shall he treated at Contractor's expense. All work shall be kept wet for 10 days and protected from extreme temperatures and weather.

13.0 MEASUREMENT AND PAYMENT

3.1 General

Except otherwise specified herein or else where in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

13.1.1 Metal lath over reinforced concrete and masonry joint.

13.1.2 Joints, junctions, corners, drip course, edges and roundings.

13.1.3 More than one layer due to any unevenness in the finished works.

13.1.4 Cutting & patching of all defective works.

13.1.5 Surface preparation , cleaning and protection as specified.

13.1.6 Water proofing agent for water proof plaster.

13.1.7 Angles beads, corner beads, stop beads, architrave beads, depth gauge edging profiles, plaster dividing profiles, interior angle profiles and plaster borders used in. plaster works as shown on drawings.

13.2 Measurement

Deductions shall not be made for ends of joints, beam posts, etc., and openings not exceeding 1.64 Sq. ft/0.5 Square meter each and no addition shall be made for reveals, jambs, soffits, sills, etc. of these openings not for finishing the plaster around ends of joints , beams posts, etc.

In case of opening of area exceeding 1.64 sq.ft/0.5 square meter each, deduction shall be made for the openings and also addition shall be made for reveal jambs, soffits, sills, etc. of openings.

Measurement for acceptably completed works of plaster/ pointing will be made on the basis of number of Sq.ft. / Square meter of the surface area plastered/ pointed as shown on the drawings or as directed by the Project Manager.

13.3 Payment

Payment will be made for acceptable measured quantity of plaster / pointing basis of unit rate per sq.ft/m^2 quoted in the Bill of Quantities and shall constitute full compensation for al the works related to the item.

Chapter-10
Painting

1.0 SCOPE

The work covered by this section of the specifications, consists of furnishing all materials, plant, labour, equipment, appliances and performing all operations in connection with surface preparation, mixing, painting concrete works, gates, frames, structural steel works, steel pipes, valves, steel and wooden doors, windows, louvers, wall, ceilings and such surfaces as shown on the Drawings and/or as directed by the Project Manager. The scope of this section of specification is covered with detailed specifications as laid down herein.

2.0 APPLICABLE STANDARDS

Latest editions of following British Standards are relevant to these specifications wherever applicable.

2.1 BSI (British Standards Institution)

245	Specification for mineral solvents (White spirits and related hydrocarbon solvents) for paints and other purposes.
2521	Lead-based priming paint for woodwork.
2523	Lead-based priming paint for iron and steel.
2569	Sprayed metal coatings.
4800	Paint colours for building purposes.
CP.231	Painting of building.
CP.3012	Cleaning and preparation of surfaces.

3.0 GENERAL

3.1 Except as otherwise specified, all painting shall be applied in conformity with BS CP 231 "Painting of Buildings" as applicable to the work.

3.2 The Contractor shall repair at his own expense all damaged or defective areas of shop-painted metal work and structural steel work. Metal surfaces against which concrete is to be placed will be furnished shop painted and shall be cleaned prior to being embedded in concrete.

3.3 Unless otherwise specified all wooden doors and steel doors shall be painted with fire resistant paint.

3.4 Except as otherwise specified, all concrete and plastered surfaces are to be painted.

3.5 The Project Manager will furnish a Schedule of colours for each area and surfaces. All colours shall be mixed in accordance with the manufacturer's instructions.

3.6 Colours of priming coats (and body coats where specified) shall be lighter than those of finish coat. The Project Manager shall have unlimited choice of colours.

3.7 Samples of all colours, stains and finishes shall be prepared in advance of requirements so as not to delay work and shall be submitted to the Project Manager for approval before any work is commenced. Any work done without such approval shall be redone to the Project Manager's satisfaction, without additional expense to the Employer. Samples shall be on separate 2'x2'x1/8"/600mm x 600mm x 3mm tempered hardboard panels.

4.0 DELIVERY, STORAGE AND CONTAINER SIZES

Paint shall be delivered to the Site in sealed containers which plainly show the type of paint, colour formula or specification number, batch number, quantity, date of manufacture, name of manufacturer and instructions for use. Pigmented paints shall be supplied in containers not larger than 20 liters. All materials shall be stored under cover in a clean storage space which should be accessible at all times to the Project Manager. If storage is allowed inside the building floors shall be kept clean and free from paint spillage.

5.0 MATERIALS FOR THE PREPARATION OF SURFACES TO BE PAINTED

5.1 Filling Compound.

These are extrudable, spreadable or sprayable compounds consisting of binders and fillers as follows.

5.1.1 Glue filling Compounds

Constituents:

* Glue, possibly with added dispersions (i.e.very fine particles of solid pigment)

* Pigments.

* Fillers.

5.1.2 Stoppers.

Shall be based on glazier's putty when used on general woodwork, litharge and glue for varnished timbers and beeswax for polished surfaces.

5.2 Sealers

5.2.1 Masonry and Other Porous Surfaces

5.2.1.1 Primer Sealer.

These shall be based on an alkali-resistant substance suitable for sealing powdery residues on surfaces prior to the application of emulsions or oil paints.

5.2.1.2 Fluosilicate Sealers.

These shall be fluosilicate acid or solutions of salts of fluosilicic acid or solutions of salts of fluosilicic acid.

* to reduce alkalinity in lime and cement plaster surfaces.

* to reduce absorbency.

* to combat efflorescence and mould formation.

* for surface consolidation of lime and cement plaster.

* for sealing of smoke and water stains.

5.2.1.3 Dispersion Sealers

These shall be sealer based on plastic dispersions or paints for sealing surfaces containing tar or bitumen, as well as rust smoke and water stains.

5.3 Primers

5.3.1 Masonry and other porous Surfaces

Constituents:

* Boiled linseed oil according to BS 242 (only on chemically neutral surface)

* Synthetic resin lacquers suitably thinned.

5.3.2 Wood and Wood Based Surfaces

These shall be:

* Blue stain inhibiting primers on a synthetic resin basis.

* Wood primers on a nitrocellulose basis.

5.3.3 Steel Surfaces

5.3.3.1 Corrosion Protection Primers

Constituents:

* Pigments (e.g. red lead, zinc chromate lead silicon chromate)

* binders(e.g. boiled linseed oil, alkyd resin lacquers, epoxy resin lacquers, polyurethane lacouers).

* fillers (e.g. barytes).

6.0 MATERIALS FOR PAINTING

6.1 All materials shall be acceptable, proven, top grade products of reputed manufacturers as approved by the Project Manager.

6.2 Colours shall be pure, non-fading pigments, mildew-proof, sun-proof, finely ground in approved medium. Colours used on plaster and concrete surfaces shall be lime-proof. All materials shall be subject to the Project Manager's approval.

6.3 All non-corrosive durable coating and primers for structural steel, metal work shall be the best available of its type and shall be approved by the Project Manager prior to its procurement.

6.4 Plastic paint of specified finish shall be used as shown on drawings and shall be of the best quality. Prior approval of the paint quality, shade and colour shall be obtained from the Project Manager.

6.5 Materials for wax polish shall be subject to approval of the Project Manager prior to use in the works.

6.6 Approved quality cement wash paint shall be used for painting the exterior of the structures or other surfaces as directed by the Project Manager.

6.6(a) Bitumen painting shall consists of bitumen grade 10/20 and it shall be used in foundations where specified. 2 coats of painting shall be applied.

6.7 Fire resistant painting shall be proprietary painting material to be applied in conformity with the recommendations and instructions of the manufacturers.

Where mentioned on drawings exposed steel structure members shall have a spray-on asbestos fire coating on the interior, the coating shall have 90 minute rating and shall be applied as per the manufacturer's recommendations and instructions after the Project Manager's approval.

7.0 SURFACE PREPARATION

7.1 All oil, grease, dirt, dust, loose mill scale and any other foreign substance shall be removed from the surface to be painted and polished by the use of a solvent and clean wiping material following the solvent cleaning, the surfaces shall be cleaned by scraping, chipping , blasting wire brushing or other effective means as approved by the Project Manager.

7.2 In the event the surfaces become otherwise contaminated in the interval between cleaning and painting, recleaning will be done by the Contractor at no additional cost.

7.3 Surfaces of stainless steel, aluminium, bronze, and machined surfaces adjacent to metal work being cleaned or painted shall be protected by effective masking or other suitable means, during the cleaning and painting operations.

7.4 All surfaces to be bitumen painted shall be thoroughly cleaned of any accretion, dust, dirt etc., by scraping, wire brushing as directed by the Project Manager. The surface shall be primed with a coat of asphalt oil used at the rate of not less than 5 liters per 32.81 sq.ft/10 .sq.meter. No. work in this section shall be allowed until all surfaces or conditions have been inspected and approved by the Project Manager.

8.0 EXECUTION

8.1 General

8.1.1 Preparation of Materials

The manufacturer's instructions are to be followed when thinning paints and in no case shall thinners exceed 5% by volume. Paints shall be stirred regularly unless otherwise recommended by the manufacturer.

Most paints are provided in a condition ready for use. It is important that only those additions and mixtures are made which are expressly permitted on the container labels or in the manufacturer's literature. Materials should not be used when either the shelf-life or the pot-life has been exceeded.

All partially used paint packages, such as kegs, drums and tins should always be properly resealed so as to avoid deterioration of the remaining material.

8.1.2 Cleanliness

In all painting operations, including preparatory work, cleanliness is essential. Completed works shall be protected by rags or polythene sheeting during painting operations.

Rags and waste which have become saturated with drying oil or paint e.g. when cleaning utensils, are liable to ignite spontaneously. They shall not be left lying about, but shall be taken away immediately. Paint containers shall be emptied and cleaned with a suitable solvent each day after use. Brushes, knives and other utensils shall be cleaned after use and be appropriately stored so as to be maintained in clean condition. Paste or size left on pails or in brush stocks can prove fertile ground for the propagation of moulds and woodwork when the contaminated articles are again used.

8.1.3 Climatic Conditions

No exterior or interior painting, finishing or sealing shall be carried out during periods of rain, sandstorm or high winds unless the areas concerned can be protected until the paint has dries.

8.1.4 Application

Materials covered by processing instructions provided by the manufacturer are to be used according to these instructions. Paint, lacquer and varnish applications and coatings may be applied by hand or mechanically.

Paint, lacquer and varnish applications and coatings must adhere firmly and appear as a uniform finish and proper flow in the case of varnish paints, using the specified materials in accordance with the following performance instructions.

Varnish and lacquer applications are to have a high gloss finish as satin finish or matt.

If filling is necessary, the surfaces are to be covered all over with filling compound and smoothed down.

When two or more coats are applied, each proceeding coat must be dry before the following coat is applied. This does not apply to wet-on-wet techniques.

Drying times stated by the manufacturer must be observed. Standing times must not be exceeded.

In doors, windows and skirting, work must be finished off with sharps and straight lines.

Coating materials containing solvents which are flammable or are injurious to health must be stored and applied in a manner which befits their special properties.

Remainders of coating materials are to be disposed of in such a manner that they cannot cause any damage, they must not be emptied into sinks, closet pans and the like.

8.2 Painting

8.2.1 All paint and coating materials shall be in a thoroughly mixed condition at the time of application. All work shall be done in a workman like manner, leaving the finished surface free from drips, ridges, waves, laps, and brush marks. All paints shall be applied under dry and dust free conditions. Unless approved by the Project Manager paint shall not be applied when the temperature of the metal or of the surrounding air is below 45 degrees Fahrenheit. Surfaces shall be free from moisture at the time of painting.

All primary paint shall be applied by brushing. The first coat of paint shall be applied immediately after cleaning. When paint is applied by spraying, suitable measure shall be taken to prevent aggregation of the paint in the container during painting operation.

Effective means shall be adopted for removing all free oil and moisture from the air supply lines of the spraying equipment.

Each coat of paint shall be allowed to dry or harden thoroughly before the succeeding coat is applied.

8.2.2 Two coats of cement wash shall be applied to exterior surfaces where shown on drawings in accordance with the manufacturer's instructions or as directed by the Project Manager.

Only as much material shall be mixed as can be used up in one hour.

Overthining will not be permitted. After the first coat the surfaces will be soaked evenly four or five times and the second coat shall be applied after leaving for at least over night.

8.2.3 All steel works including steel doors, windows and ventilators shall be painted as follows:

a) Internal surfaces of door frames, and double skin shutter shall be given one coat epoxy primer.

b) All other external surfaces of door frames and shutters shall be given two coats epoxy primer and finished with two coats of epoxy enamel paint.

c) External surfaces in contact or embedded in concrete shall not be painted, greased, or oiled at all. However, these surfaces shall be given a cement wash after blast cleaning.

d) Film thickness of each coat of paint and other relevant installation regarding its application shall be as specified by the paint manufacturer.

8.2.4 Three coats of plastic emulsion paint of the approved make and shade shall be applied to all specified interior surfaces as per manufacturer's instructions or as directed by the Project Manager.

8.2.5 Where specified on the drawings, three coats of polyvinyl distemper of approved make shade and colour shall be applied to interior surfaces as per manufacturer's instructions and directions of the Project Manager.

8.3 Polishing

8.3.1 Polishing and Waxing

After fine sanding by a skilled operator, One coat of polish should be rubbed in by hand using a cloth or pad, be allowed to dry and buffed up with worn fine sandpaper or steel wool to remove raised grain. A second coat of polish should then be applied. When this is dry a paste wax should be applied sparingly, be allowed to dry and then buffed up by machine or by hand. Subsequent coats of wax may be applied as necessary.

9.0 MEASUREMENT AND PAYMENT

9.1 General

Except otherwise specified herein or else where in the contract documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

9.1.1 Preparatory works, including preparatory materials, scraping, scratching, sand blasting, cleaning, priming, protection of finished works etc.

9.1.2 Wax polishing to specified wood works including preparatory works and materials.

9.1.3 Fire resistant painting to metal works including preparatory works.

9.1.4 Painting and prime coating to all steel doors.

9.2 Measurement

Measurement of acceptably completed works of paint to surfaces will be made on the basis of net actual area in sq./ft/sq.meter painted as shown on the drawings or as directed by the Project Manager.

9.3 Payment

Payment will be made for acceptable measured quantity of paint to surfaces on the basis of unit rate per square meter quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the items.

Chapter-11
Carpentry and Joinery

1.0 SCOPE OF WORK

The work covered under this section of Specification consists of providing all material, labour, plant equipment appliances and performing all operations conducted with the fabrication add erection of all woodwork, millwork, construction, assembly, surface finish treatment and building in of all cabinet type items, supports, etc, of wood or metal and incidentials, associated woodwork appurtenances, procuring and applying preservatives, installation of "Finish Hard Ware" in connection with finish woodwork as per details shown on the drawings or as this section is covered with detailed specifications as laid down herein.

2.0 SUBMITTALS

2.1 Samples of all the materials and components.

2.2 Shop Drawings showing door types, details and locations, referenced to the door type and hardware group shown on door and hardware schedules.

2.3 Certificates stating that doors were constructed with timber of the species specified having mixture content and meeting equilibrium and relative humidity requirements specified.

2.4 Sample efface veneers for selection of colour and pattern.

3.0 APPLICABLE STANDARDS

Latest editions of following; Pakistan, British and ASTM standard are relevant to these Specifications wherever applicable.

CP 112-71	The structural use of timber in buildings.
IBS 459-65	Match boarded doors.
168 565-72	Glossary of terms relating to timber and woodwork.
BS 745.69	Animal glue for wood.
881186-71	Quality of timber and workmanship in joinery.
BS 1202-74	Nails
BS 1203-79	Specifications for synthetic resin adhesive for plywood.
BS 1204-79	Synthetic resin adhesives for wood.
BS1210-63	Wood screws.
BS 1245-75	Metal door frame (steel).
BS 1282-75	Guide to the choice, use and application of wood preservatives
6S 1455-72	Plywood manufactured from tropical hardwoods.

BS 1494-51	Fixing accessories for building purposes.
BS 1567-60	Wood door frames and linings.
BS 1579-60	Connectors for timber.
BS 3444-72	Block board and laminated board.
BS 3842-65	Treatment of plywood with preservatives.
BS 5268 Pt.5 1977	Preservative treatments for construction timber.

4.0 TOLERANCES

- Size: Plus or minus 1.6 mm overall dimensions
- Maximum warp: 6mm
- Squareness: Maximum diagonal difference 3 mm (between length of diagonal measured on face of door or window from upper right corner to lower left comer and length of diagonal measured from upper left comer to lower right corner).

5.0 DELIVERY AND STORAGE

5.1 Deliver and store products in waterproof, protective containers with seals unbroken and labels intact until time to use.

5.2 Keep products dry, stack products off ground on level platforms, fully protected from weather, including direct sunlight.

5.3 Identify type, size and location of each door ventilator before delivery in order to permit installation at correct location.

5.4 All materials and assembled units are to be protected from weather and stored in such a way as to prevent decay and attack by fungus and termites.

6.0 PRODUCTS

6.1 Timber

6.1.1 General Characteristics

The timber shall be in accordance with the requirements of" BS: 1186 'Quality of Timber and Workmanship in Joinery', Part 1,' Quality of Timber'. .

First quality timber shall be from the heart of a sound tree, the sap wood being entirely removed, the wood being uniform in substance, straight in fiber, free from large or dead knots, flaws, shakes or blemishes of any kind. The colour of good timber shall be uniform through out and among coloured timbers darkness of colour is an apparent indication of strength' and durability.

For first quality deodar wood, the size of the knot shall not be more than 25 mm and there shall not be more than one knot in every 0.4 Sq.meter of timber.

6.1.2 Seasoning of Timber

Timber shall be properly seasoned. It shall be kin or air dried to reduce the moisture content to a maximum of 15% of its natural weight.

6.1.3 Hard and Soft Wood

Door trances, glazed, semi glazed and paneled shutters and core of flush doors shall be made in soft wood unless otherwise specified.

Softwood .consists of deodar, chili, partal and maranti. Unless otherwise specified or allowed by the Project Manager only deodar wood shall be used for softwood. Hardwood consists of Shisham, Teak, Iroko, Walnut, Mahogany, beach or oak whichever specified.

6.1.4 Preservation of Wood

Prior to installation of finish wood works in their respective positions, preservatives shall be applied to safeguard the wood work against fungus, termite and borers.

The preservatives shall be of the best available quality as approved by the Project Manager. The method of application shall be strictly in accordance with the manufacturer's instructions.

6.2 Plywood and Veneer

6.2.1 General

BS: 565 Section 5, 'Glossary of Terms Applicable to Plywood', defines plywood as 'an assembled product made up of plies and adhesives, the chief characteristic being the crossed plies which distribute the longitudinal wood strength. The term ply wood in general sense includes similar products such as laminated board, block board and batten board. BS: 1455 shall be used for acceptable standards of plywood.

6.2.2 Three Ply and Multi-Ply Wood

Three ply construction includes a 'face' a 'back' and a core of inner ply. Multi-ply includes a face, a back and a core of three or more inner plies. With very few exceptions the grain of each veneer in the core runs at- right angles to that of the veneers on either side of it.

The construction of plywood may be balanced with an odd number of Veneers arranged symmetrically or unbalanced. The tendency of the finished board to distort is reduced by adopting a balanced construction.

The construction may vary for a given panel thickness by the inclusion of veneers of various thickness. This will affect the strength properties.

62.3 Interior and Resin Bonded

Plywood according to BS: 1455 is classified into two main types, viz interior and resin bonded.

Interior type plywood is suitable for most interior work including flush doors, door panels, and any location where resistance to moisture is not required. Adhesive used include casein, soya, blood albumen and animal glues as well as synthetic resin extended with other substances.

Synthetic resin bonded plywood while being suitable for the same purpose as interior type, has a much greater resistance to moisture. The more resistant types are suitable for external flush doors and door panels,

Shop front facias, and for any purpose where it may be exposed to moisture. Adhesives used include urea, melaminephenol and resorcinol formaldehyde (arranged in order of increasing moisture resistance).

6.2.4 Veneer

Grade I Veneer shall be of one piece of firm smoothly cut veneer. The veneers shall be free from knots, worm and beetle holes, splits, dots. glue-stains, filling or inlaying of any kind or other defects. No end joints are permissible.

Grade II Veneer shall present a solid surface free from open defects. Veneer may be in one or two pieces. Pieces of Veneers when jointed need not necessarily be matched for colour or be of equal width. A few sound knots are permitted with occasional minor discoloration and slight glue stains, isolated pin holes not along the plane of the veneer.

The uses, for which plywood made with the grades defined above are considered useful, are outlined hereunder:

Grade I For Use in its natural state.

Grade II For use where subsequent painting and /or veneering is intended.

6.2.5 Laminated Board

This is built-up board, with narrow strip 3 to 7 mm wide, faced both sides with either one or two veneers from 1.2 mm to 3.7 mm thick. Where single or double face veneers are used, the grain usually runs at right angles to the grain of the core strip. This type of board when available varies between 13 mm to 25 mm in thickness and is an ideal base for the highest class of veneered wood. For detailed specifications BS; 3444 'Block Board and Laminated Board' shall be used.

6.2.6 Block Board

This board conforming to BS 3444 is of similar construction to laminated board but core is built-up of blocks upto 25 mm wide. It is used as a base for veneering and for painted work but is considered slightly inferior to laminated board for the former use. The range of size and thicknesses in which it is manufactured are similar to those of laminated board.

6.3 Adhesives

For joiners work animal glues complying with BS: 745, 'Animal Glues for Wood' or synthetic resin adhesive complying with BS: 1204, ' Cold Setting Synthetic Resin Adhesives for Construction Work in Wood' shall be used. For flush doors and other forms of construction that rely mainly upon the adhesive, and particularly where exposure conditions are severe and prolonged dampness is likely to occur, one of the more moisture resistant adhesives shall be employed, the choice depending upon the severity of the conditions to which the work will be exposed.

6.4 Hardware

6.4.1 Nails and Screws

For joiners work, wire nails oval, chequered head, lost head round or panel-pins complying with BS: 1202, ' Wire Nails and Cut Nails for Building Purposes' or wood screws in accordance with BS: 1210 shall be used. The gauge of nail or screw used shall be suited to the woods being fixed and to which a fixing is being made, and the length shall be such as will give a sufficiently strong and secure fixing. CP: 112. ' The Structural Use of Timber in Buildings' shall be followed which gives relationship between gauge, amount of penetration and strength. All nails and screws used with reactive timber (becoming stained and dis-figured by reaction with ferrous metals) shall be of non-ferrous metals or shall be protected in some manner before use if the wood work is likely to be subjected to moist conditions, e.g. external doors.

6.4.2 Holdfast

- Crank shaped holdfast of size 200 mm x 40 mm x 3 mm made of steel plate. One end to be fixed with 100 mm x 10 mm long screws.

- Crank shaped holdfast of size 300 mm x 40 mm x 3 mm made of steel. One end to be fixed with 100 mm x 10 mm long screws.

6.4.3 Hinge

- Oxidised brass built hinge of size 100 x 50 mm weighing 0.14 Kg with the standard size of brass pins fixed with brass screws of required size.
- Double-action Oxidised brass, spring-butt-hinge of size 100 x 50 mm weight 0.28 Kg each with standard size pins and spring fixed with brass screws of required size'.
- Extra heavy steel-butt-hinge of size 130 mm x 80 mm weighing 0.45 Kg with standard size of pins fixed with appropriate size of steel screws.

6.4.4 Tower Bolt

- Oxidised brass, 150 mm long, weighing 0.14 Kg each fixed by means of appropriate size of brass screws;

- Sled, 150 mm long, weight 0.29 Kg each fixed by means of appropriate size of steel screws;

6.4.5 Handle

Oxidised brass or aluminium alloy, 100 mm long fixed with the screws of the same material.

6.4.6 Stopper

Foot-operated friction door stopper of best quality available locally and is approved by the Project Manager,

6.4.7 Lock

Automatic dead locking mortise lock with two bevelled latches and handles and COLOMBO DESIGN locks and knobs complete or equivalent available locally and as approved by the Project Manager.

6.4.8 Hydraulic Door Closer

Single-action type, face fixing, best quality available and as approved by the Project Manager.

The size and weights of all the above materials are approximate.

Hardware shall be carefully and securely fitted. Upon handing over the work hardware shall be demonstrated to operate freely. Keys shall be placed into respective locks and upon acceptance of the work. keys shall be tagged and delivered to the Project Manager in duplicate.

7.0 EXECUTION

7.1 Fabrication

All "Wrought" timber is to be sawn, planed, drilled or otherwise machined or worked to the correct sizes and shapes required.

The joiner shall perform all necessary mortising, tennoning, grooving, matching. tonguing, rebating and all other works necessary for correct jointing. He shall also provide all metal plates, screws, nails and other fixings that may be necessary for the proper execution of the joinery works specified. The joiner shall also carry out all works necessary for the proper construction of all framings, linings, holdfasts and other contrivances as per architectural details and/or instructions of the Project Manager for their adequate support and fixing in the building.

Loose joints are to be made where provision is required to be made for shrinkage or other movements acting in the direction other than that of the stresses because of loading. Glued joints are to he used where provision need not be made for shrinkage or other movements in the connection, and where sealed joints are required. All glued joints shall be cross-longued or otherwise reinforced. All nails, springs etc. shall he punched and puttied. All cutting edges of tools shall be sharp to avoid burnishing.

All wood work, as fat- as practicable, shall be assembled in shop, finished and prime coated before delivery for fixing. In addition to machine sanding, all woodwork shall be smoothed by hand using "00" sand paper to have the required smooth surface, free from machine and tool marks, abrasions, raised grains and other defects. All wood work shall be fitted to plaster and other finished work in a careful manner so as not to injure these surfaces. Where plaster or other work is damaged or disturbed, it shall be restored to its original state by the Contractor at no additional cost.

All wood work shall be neatly finished to the exact dimensions specified. All nails and screws shall be of approved type. Hammer shall not be used for driving in or starting in the screws. All screws shall be dipped in oil before they are inserted in the wood. The heads of nails or screws shall be sunk and puttied or dealt with as directed by the Project Manager.

7.2 Priming

Where priming is specified, the timber shall be coated with a thick mixture of red or white lead and linseed oil. The Contractor shall provide for priming and touching up primer where necessary during the progress of work.

7.3 Door frames

The door frames shall be secured in place by means of corrugated anchors of non-ferrous metal or galvanized ferrous metal bent up against the back of the jambs and screwed in place and built into the masonry as it is being constructed. There shall be one such anchor near the top and bottom of each jamb at not over 900 mm intervals between the top and bottom anchors. Frames shall be secured to the anchors by means of 9 mm diameter bolts or screws extending through the frames, beads of bolts or screws shall be countersunk and covered with the stops, which shall be screwed in place.

7.4 Fitting Door Shutters

All the doors shall be fitted, hung and trimmed as hereinafter specified and as indicated on the Drawings.

Doors shall have a clearance, of 4 mm at sides and top unless otherwise directed by the Project Manager and shall have 20 mm clearance at bottom. All the doors having a thickness of 44 mm or more shall have the lock or latch edge bevelled at the rate of 3.0 mm in 50 mm. Doors shall be hung and trimmed with hardware as specified. All the locks shall be installed at the same height. Knob locks and knob latches shall be located at height as directed by the Project Manager. Door locks shall have the centre of the locks at the same height as the centre of the knob locks.

8.0 MEASUREMENT AND PAYMENT

8.1 General

Except otherwise specified herein or else where in the Contact documents, no measurement and payment will be made for the under mentioned specified work related to the relevant items of the bill of quantities.'The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

8.1.1 All finished hardware fittings in carpentry and joinery works.

8.1.2 Glass and glazing including other materials and accessories required for installation and finishing.

8.1.3 Prime coat, painting and wax polish in carpentry and jointry works.

8.1.4 Antitermite treatment to wood works.

8.1.5 Adhesives.

8.1.6 M.S. steel plate, non-shrink grout, teak wood plank, rough wood, sleeve, lead caulking, polishing and painting and as shown on drawings.

8.2 Measurement

Measurement of acceptably completed quantity of all types of polished wood works will be made on the basis of net actual area in sq.ft. meter, fabricated and installed in position as shown on the drawings or as directed by the Project Manager.

8.3 Payment

Payment will be made for acceptably measured quantity of all types of wood works on the basis of unit rate per sq.ft. meter quoted in the bill of quantities and shall constitute full compensation for all the work related to the item.

Chapter-12
Glazing

1.0 SCOPE OF WORK

The work covered under this section of the specifications consists of furnishing all labour, equipment, tools, appliances, scaffoldings and providing glass, gaskets, sealant, compounds and accessories required for performing all operations in connections with the installation and setting of glass, complete in every respect in accordance with the drawings or as directed by the Project Manager. The scope of this section of specifications is covered with detailed specifications as laid down herein.

2.0 APPLICABLE STANDARDS

Latest editions of following British Standards are relevant to these specifications wherever applicable.

2.1 BSI (British Standards Institution)

952 Glass for double glazing.

CP.152 Double glazing.

3.0 GENERAL

3.1 Each type of glass shall have the manufacturer's label on each pane, and the labels shall remain on the glass until final cleaning.

3.2 Glazing sealent shall be as recommended by the manufacturer for the particular application.

3.3 Spacer shims (distance piece) shall be plasticised polyvinyl chloride (PVC). Thickness shall be equal to space shown on drawings between glass and rebates, bead or cleat. Depth shall give not less than 6mm cover of glazing sealant.

3.4 Contractor shall submit samples for each type of glass, minimum 4"x4"/100mm x 100mm in size with protective edges. Samples of glazing sealant minimum 0.1 litre of specified types shall be submitted. Samples of minimum of three glass blocks shall also be submitted.

3.5 Contractor shall submit 12"/300 mm long sample of each type of double glazing gasket.

3.6 Contractor shall also submit printed materials manufacturers, installation instructions for specified glazing, gasket, compounds, sealant and accessories including description of required equipment, procedures and precautions to be observed.

4.0 DELIVERY STORAGE AND HANDLING

4.1 Contractor shall deliver materials in manufacturer's original, unopened containers clearly labeled with manufacturer's name and address, material, brand, type class and railing as applicable.

4.2 Contractor shall store the materials in original unopened containers, with labels intact, protected from ground contact.

4.3 Contractor shall handle the materials in a manner to prevent breakage of glass and damage to surfaces.

5.0 MATERIALS

5.1 General

Glass shall be free from all blemishes, bubbles, distortions and other flaws of any kind and shall be properly cut to fit the rebates so as to have a uniform clearance of 1.6 mm (1/6 inch) round the panes between the edges of glass and the rebates. All glass shall be of best quality manufacture as approved by the Project Manager.

5.2 Type of Glass

5.2.1 Plain / Tinted Glass.

Glass for doors and windows shall be "ANTISUN FLOAT 41/60 Brown from PILKINGTON GROUP" or equal where the sheet glass is to be used and for double glazing imported order made double layer vacuum glass of appropriate thickness tinted as selected and as approved by the Project Manager.

5.2.2 PSG Heat-strengthened glass or PSG Tempered glass, safe glass, with a compressed layer on its surface manufactured by heating up flat glass to a temperature of around 700 C and then blowing air on to its surface, quenching it down swiftly and uniformly. It can be divided into two types depending on the degree of heat treatment, heat-strengthened glass or tempered glass PSG heat-strengthened glass in manufactured by controlling the tensile stress caused by heat treatment process with in a certain range of Temperature. PSG tempered glass has an impact strength which is 5 times higher than that of the annealed flat glass of the same thickness, as well as 3 to 4 times higher resistance to weight.

5.3 Rubber acrlyic glazing sealant.

5.3.1 Two component polysulfide glazing sealant.

5.3.2 One component acrylic glazing sealant.

5.3.3 Acrylic - latex glazing sealant consisting of modified latex rubber and acrylic emulsion, non hardening, non-staining and non-bleeding.

5.3.4 Cleaners, Primers and sealer as recommended by the sealant manufacturer.

5.4 Accessories

5.4.1 Vinyl Glazing Bead.

It shall be for external windows and entry doors and shall be in accordance with glass manufacturer's recommendation.

5.4.2 Glazing Type

It shall be type or ribbon of polymerized butyl or mixture of butyl and polyisolbutylene compounded with inert fillers and pigments, solvent based, 95 percent solids thread or fabric reinforcement, paintable, non-staining.

5.4.3 Setting Blocks

It shall be chloroprene (Neoprene) 70 to 90 durometer hardness, compatible with sealant used, channel shaped and of the necessary height for proper perimeter clearance.

5.4.4 Channels, Gaskets, and Spacer's.

It shall be chloroprene (Neoprene) 40 to 50 durometer hardness compatible with sealant used.

6.0 INSTALLATION OF GLAZING

6.1 Glazing shall comply with the recommendations contained in the "MANUAL OF GLAZING" of the flat glass marketing Association or as specifically recommended otherwise by the glass and glazing materials manufacturers.

6.2 Examine each piece of glass and discard and replace glass with new glass, if edge damage or face imperfection is found.

6.3 Clean glazing channels and other framing members indicated to receive glass. Remove coatings which are not firmly bonded to the substrate, Remove lacquer from metal surfaces wherever elastomeric sealant are to be used. Apply primer and sealant manufacturer.

6.4 Trim and clean excess glazing materials from surrounding surfaces immediately after installation and eliminate stains and discoloration.

6.5 Cure glazing sealant and compounds in compliance with manufacturer's instructions, to obtain high early bond strength internal cohesive strength and surface durability.

6.6 No glazing shall be considered complete until and unless paint and other stains have been removed from the surface of the glass.

6.7 While glazing operation is in progress great care shall be taken to avoid breakage or damage to the glass and adjoining glazing. The Contractor shall make good at his own cost, all glass broken by his workmen while cleaning or carrying out other operations. On the completion of the glazing work, all glass that has been set by Contractor shall, if it becomes loose, within the maintenance period, to be re-fixed at Contractor's expense.

7.0 PROTECTION AND CLEANING OF GLAZING.

7.1 Remove all smears, labels and excess glazing sealant, leave clean inside and outside and free from scratches. The Contractor shall be responsible for the protection of installed glass. Before final acceptance, damaged or broken glass shall be removed and replaced with new glass at no additional expense to the Employer.

7.2 All glazed surfaces shall be washed clean both inside and outside within two weeks prior to final acceptance by the Employer.

8.0 MEASUREMENT AND PAYMENT

No Payment shall be made for the works involved within the scope of this section of specifications unless otherwise specifically stated in the Bill of Quantities or herein.

The Cost thereof shall be deemed to be included in the quoted unit rate of the relevant item of the Bill of Quantities.

Chapter-13
Suspended False Ceiling

1.0 SCOPE OF WORK

The work covered by this section of the specifications consists of furnishing all plant, labour, equipment, appliances materials and performing all operations in connection with installation of false ceiling including suspension system complete in strict accordance with this section of the specifications, the applicable drawings and subject to the terms and conditions of the Contract.

2.0 MATERIAL REQUIREMENTS

a) Plaster of Paris False Ceiling

Suspended ceiling shall comprise of 1/2" thick plaster of paris panels screwed to wooden frame consisting of partal wood runners 2"x2" both ways at specified c/c distances and in various sizes as shown on drawings. The material for the ceiling shall be in accordance with these specifications provided for the item of work and its thickness and dimensions shall conform to the item as provided in the Bill of Quantities or as shown on the drawings or as directed by the Engineer.

b) Dampa False Ceiling

Suspended aluminium false ceiling shall be standard products offered by the manufacturer / supplier DAMP or equal. DAMPA grid system shall be profiled units available In standard lengths. Each unit shall have an inlay of glued polythene foil and a pad of material wood 12mm thick. The approved manufacturers shall be DAMPA or equal.

3.0 SUBMITTALS

The Contractor shall submit the following for approval of Project Manager:

3.1 Shop Drawings showing reflected ceiling plan, locations of built-in products and access facilities, dimensions, layout arrangements, hanger locations, structural connection, details of level changes, direction of pattern and panel-joint details.

3.2 Samples of false ceiling panels, suspension system, and accessories including sealant, furring and runner channel etc.

4.0 DELIVERY AND STORAGE

4.1 Material shall be delivered in original, unopened, protective packaging, with manufacturer's labels indicating brand name, pattern, size, thickness and fire rating.

4.2 Material shall be stored in original protective packaging to prevent soiling, physical damage or wetting.

4.3 Cartons shall be stored in the installation area, opened at each end to stabilize moisture content and temperature, for 48 hours prior to installation.

5.0 QUALITY ASSURANCE

5.1 INSTALLER QUALIFICATIONS: Workmen shall be skilled, well trained and experienced In their respective crafts and familiar with specified requirements and methods.

5.2 TOLERANCES; Suspension system components, hangers, fastening devices, supporting light fixtures, metal pan tiles and others shall be so installed that maximum deflection is not more than l/360th of the span. Allowable tolerance of finished ceiling system shall be level to within 3 mm in 4m.

6.0 PLASTER OF PARIS FALSE CEILING

The False Ceiling false ceiling shall be of the approved manufacturer and of approved pattern, Band thickness as per approved shop drawing.

6.1 Hanges

Hangers shall be 1/8" M.S. flat. It shall be the responsibility of the Contractor to get the sample of hanger approved by the Project Manager.

6.2 Angles and Tees

Angles and Tees shall be of Aluminium section of approved pattern as per shop drawings approved by the Project Manager.

7.0 EXECUTION

7.1 General Requirements

7.1.1 False ceiling shall be installed wherever indicated on the Drawings by skilled technicians experienced in this type of work,

7.1.2 Work which will be concealed by false ceilings shall be completed, tested, inspected and accepted before ceiling work is started.

7.1.3 False ceiling installation shall not begin until the area has been closed in. Wet work shall be cured and dried before ceiling work is started.

7.1.4 Surfaces which will support the ceilings, and those to which the ceiling abut, shall be inspected and accepted for completeness and adequacy before the work begins.

7.1.5 Temperature shall be maintained at 10 degree Centigrade or above while system is being installed.

7.1.6 Application of ceiling units shall be done in strict accordance with the manufacturer's specifications unless otherwise modified.

7.1.7 Ceiling units shall be Installed in a true and even plane, in straight line, courses laid out symmetrically about center lines of ceiling or panels.

7.1.8 Reinforcement shall be provided around openings of electrical lighting, air diffusers and access panels as indicated and shown on drawings.

7.1.9 Reinforcing bracing for hanger bolts shall be provided where the height of space in ceiling is more than 1.5 meters.

7.1.10 Access panels shall be furnished and installed as shown on drawings in strict accordance with manufacturer's specifications.

7.2 Installation

False ceiling suspension system and panels shall be installed in accordance with the requirements of BS - CP. 290 and with the manufacturer's recommendations as approved by the Project Manager. Project Manager shall be notified of any discrepancies which preclude installation in patterns shown prior to execution of work.|

7.2.1 The hangers; as specified shall be evenly disposed as per shop Drawings, details and placed in position as indicated.

7.2.2 The framing shall be of the specified section and run at spacing as per shop Drawings. The jointing of battens to hangers and the extra framing if required shall be provided for light receptacles/ air-conditioning as per approved shop Drawing.

7.2.3 Wall angles shall be positively and rigidly connected to the structure and to cross runners.

7.2.4 False Ceiling shall be installed in the grid system after completion of installation of the suspension, lighting fixtures and ventilating unit.

7.2.5 Light fixtures and ventilating units shall be installed in grid pattern shown and supported in accordance with manufacturer's recommendations.

7.2.6 After Installation, dirty, soiled or discolored surfaces shall be cleaned and left free from defects and ready to receive any painted finish if required.

7.2.7 The panels which are damaged or Improperly installed be removed and replaced by the Contractor at his own cost.

7.2.8 At completion of the work an additional 20 Sq. meter of ceiling material each of different types with sound absorbing elements and hanging system components shall be delivered to the Employer. These materials shall be packaged for easy storage.

7.2.9 Metal lath plaster ceiling shall consist of expanded galvanized metal lath suspended to an approved framing system consisting of main runners and cross runners of Steel channels, bars, clips or other devices as approved by the Project Manager.

3/5"/15mm thick cement sand plaster in the mortar ratio of 1:4 shall be applied smooth over metal lath to completely cover both internal and external surfaces of the metal lath.

Ceiling shall be applied with two coats of approved paint and finished fine, smooth to the acceptance of the Project Manager.

8.0 MEASUREMENT AND PAYMENT

8.1 General

Except otherwise specified herein or else where in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

8.1.1 Galvanized iron bar, suspension system, screws, False Ceiling material and other accessories.

8.2 Measurement

Measurement of acceptably completed works of false ceiling will be made on the basis of net actual area of false ceiling installed in position as shown on the drawings or as directed by the Project Manager. |

8.3 Payment

Payment will be made for acceptable measured quantity of false ceiling works on the basis of unit rate per sq.ft. / sq. meter quoted in the Bill of Quantities for all the works related to the item.

Chapter-14
Roof Water Proofing System

1.0 SCOPE OF WORKS

The works covered by this section of the specifications consists of furnishing all plants, labour and material performing all operations. In connection of water proofing according to specifications given below;

2.0 This subsection covers furnishing and installing roof waterproofing system in accordance with the requirements shown in the drawings as specified herein:

a) Sequence of operation: Sequence of operation depends upon the individual steps as are listed below for the application method.

b) Preparation of Surface., Remove alt dirt and dust from the surface. Thorough clean-up of surface with a broom. The cleaned surface is then surveyed and all depressions and pits in the roof of size more than 5mm are replained with sand/cement mortar before prime coat.

i) Prime Coat: The surface to be sealed has to be cleaned of dirt, dust and all loosed materials by sweeping it thoroughly with a broom. The cleaned surface is then primed with bitumen (SIB) PB3 or PB4 with kerosin oil.

ii) Preparation of surface before water proofing.

iii) 0.157" (4mm) thick ecogum torch on membrance.

iv) One layer of polythene sheet 0.008" thick.

v) 1-1/2" thick brick tiles in 1:6 cement mortar and joint filling in 1:3 cement mortar cleaning the surface curing etc. complete.

3.0 SAMPLES

The contractor shall get samples of all the materials used for the items under this section approved by the Engineer and the same type of materials shall be used throughout the work. Any materials required by the Engineer to be tested, shall be got done by the Contractor at his own cost from the Laboratory approved by the Engineer.

4.0 PROTECTION

The Contractor shall take every care to maintain the slopes, levels and shall protect the work from any damage during the construction and maintenance period. The Contractor shall have to remove, replace and rectify such damaged work at his own cost and risk.

5.0 MEASUREMENT

Measurement of roofing, shall be in square Ft. of the actual surfaces complete and approved by the Engineer.

6.0 RATE AND PAYMENT

The rate for roofing shall include all materials used for roofing, all labour, equipment, heating and other operations required to complete the work in all respects to the satisfaction of the Engineer and as specified.

General Requirements for Plumbing Works

1.1 SCOPE OF WORK

The work under these specifications include providing of materials and equipment and performing all the works necessary for the complete execution of all plumbing work as shown on plumbing and general construction drawings, except as otherwise specifically mentioned and which without excluding the generality of the foregoing shall include but not be limited in the following principle items of work:-

a) Sanitary and Drainage system.
b) Cold water system.
c) Hot water system.
d) Testing and commissioning of the installation.
e) Optional item of work.
f) If anything has been omitted or any item of work or materials usually furnished, which are necessary for the completion of the plumbing work, then such items of work must be and are hereby included in this section of work.

1.2 WORKS NOT INCLUDED

a. All concrete foundation of bases required for plumbing equipment.
b. All wiring work, switches, power points for appliances, mortors, etc.
c. All wooden access doors for the plumbing installation.
d. Brain pipes penetrating the roof and the flushing of roof drains.

1.3 MATERIALS

All materials shall be in accordance with the types and manufacturer described in the Bill of Quantities and / or shown on the relevant drawings. Where contractor desires to use materials differing from those described, he shall obtain the approval of the Engineer in writing before tendering.

Materials shall accord with the appropriate Pakistani and British Standard and Codes of Practice. Rights are reserved to inspect material not complying with the specifications. The cost of any dismantling and re-erection of the rejected materials shall be borne by the Contractor.

1.4 CUTTING

Contractor shall work out in advance the position of holes channels, cutouts, etc. to be left by the Civil contractor. Where this is not reasonably possible cutting and chapping of wall, etc. may be permitted. All cutting and chipping of wall. etc. for the installation of materials relating to plumbing work will be done by the plumbing contractor who shall also repair any damage caused and will be responsible for brinking back the general finish to the position that it was before the cutting and chipping was done.

All curing, chipping, repairing, patching of plaster, finishing of carpentry work, metal work, concrete work etc., which may be required for the plumbing work shall be done by craftman skilled in their respective trades. When cutting is required it shall in their respective trades. When cutting is required it shall be done in such a manner as not to weaken walls partition, floors etc. and holes required to be cut in floors must be drilled without excessive breaking around the poles.

1.5 PROTECTION OF FIXTURES

Such precautions as are necessary must be taken to protect all apparatus, fixtures, appliaces, materials, equipment, and installations from damage of any kind by the plumbing contractor. Failure to provide such protection to the entire satisfaction of the Project Manager shall be sufficient cause for rejection of any particular pieces of materials. Contractor shall project his own from damage during , and as may be necessary, after installation and shall likewise protect adjoining work of other trades from damage resulting from installation of plumbing work.

1.6 CO-ORDINATION OF WORK

The Contractor shall carefully check space requirements with other contractors and ensure that fixtures, pipes etc. can be installed in the space allocated for the same. The Contractor shall thoroughly acquaint himself with the work involved and must verify all the measurement necessary for the proper installation of plumbing work.

The contractor shall manufacturer's drawings of the following equipment giving full information as to dimensions, materials, capacities, and other pertinent data and obtain prior approval of the Project Manager before materials in question are ordered or installed:

a) Plumbing fixtures and supports.
b) Plumbing accessories.
c) Storage water heater.
d) Instant water heater.
e) Domestic water pumps.

If the shop drawings deviate from the contract documents the contractor shall advise the Project Manager of the deviation in writing and reasons for deviations at the start of the project.

1.7 CARE DURING INSTALLATION

Contractor shall be responsible for his work until complete and finally accepted and shall replace any material which is damaged, lost, or stolen without any additional cost to the owner. All open ends of pipes shall be closed by a plug so as to prevent obstruction and damage.

Use of any plumbing fixture intended for installation in the building during the progress of work is strictly prohibited. Immediately after installation all metallic / plated fixtures shall be thoroughly covered with non-corrosive grease which shall be maintained until all construction work is complete.

MEASUREMENT AND PAYMENT

The item shall be measure as per the unit in the Bill of Quantities. Payment shall be made for the work completed as per specifications and Bill of Quantities and to the approval of the Project Manager.

PRECEDENCE

The specifications given hereinafter are general and shall be read in conjunction with the details given on the drawings and the Bill of Quantities shall have procedence over both.

2. WATER AND SEWERAGE LINES

2.1 GENERAL

All pipes shall be as shown on the drawings or as directed during laying and shall be straight and as direct as possible, forming right angles to the building lines or paralled to it. All vertical runs shall be true in plumb, suitably spaced, and shall be paralled to other lines, with close coordination between contractors of other trades of air-conditioning, heating, gas, telephone, electrical etc., so as to avoid un-necessary cutting of floors, walls, or slabs. Offset in the runs will not be permitted unless required to follow walls, beams or plumbing fixtures.

The layouts and connection of pipes, fixtures etc. shown on the drawing shall be taken as a closer proximation. The plumbing contractor shall be responsible for accurately laying out the work and obtain the approval of the Project Manager for his shop drawings and manufacturers drawings.

Generally all piping and connections shall be concealed inside the building and burried in ground outside the building unless otherwise specified.

2.2 WATER SUPPLY

All pipes and fittings internal to the building whether exposed, or concealed in brick/concrete/floor or un-underground shall be thoroughly cleaned of all foreign matter prior to installation. The material and workmanship shall conform to C.P.310 1965 and shall be of Hysons make or approved equivalent.

All threads shall be neatly cut with sharp tools and jointing procedure shall conform to best procedure, with at least 5% of fittings jointed to straight pipes tested by application of pressure in pipe vices. These shall be free from blisters or cracks. Joints shall be made with the application of graphit / engine oil and pipes after cutting shall be reamed. A paste of white load or some approved compound with few thing strands of cotton yarn shall be applied to threads before fittings are screwed on.
All G.I. Pipes shall be screwed with pipe fitters tongs or wrenches tightly to ensure the joints being water tight. All chromium plated piping shall be so cut and threaded that no uplated is viable. All brass pipes shall be jointed with friction wrenches and vices. Any pipe showing tool marks etc. shall not be used in the installation.

All pipe work to be concealed, shall first be laid, jointed, tested and proved to be water tight before being covered up, and shall be tested to a hydrostatic pressure of 150 psi guage.

Bends, tees, reducers and other specials shall be provided as shown on drawings. All changes in direction shall be made with long radius elbows and use of bends shall be restricted unless special site conditions warrant their use.

Pipe sleeves shall be used when the piping crosses any structural member precast or cast in situ, of ample diameter embedded therein. The contractor shall coordinate his pipe layout with the Civil Contractor for the exact location of the pipe sleeves.

All hot water lines shall polystyrene performed pipe insulation of 1" thickness for main and branch lines and 1/2" thickness for fixture branches and shall be sealed with suitable adhesive.

All insulation exposed to weather shall be jacket of 45 Lbs. roofing felt which will cover all piping with a 3" lap. The insulation shall be fastened with soft wire or aluminium bends at 12" c/c/ and at all fittings and valves. All fittings and valves shall be insulated with 1" thick plystyrene, preformed pipe insulation to a thickness equal to adjoining pipe insulation and the cost shall be deemed to be included in the per foot length quoted by the tenderes for insulation in the bill of quantities.

2.3 SANITARY WORKS

All pipes and fitting internal to the building and upto the connection to the trunk sewer for soil, waste, vent or drainage shall be of cast iron or reinforced concrete of given internal diameter as perspecified on the drawings and Bill of Quantities. The interior of all pipes shall be thoroughly cleaned of all foreign matter prior to installation. The material and workmanship shall conform to CP 304.1968.

The cast iron spun pipes shall be heavy duty type with spigot and socket joints and shall be of TEEPU or ALPINE brand or approved equivalent. The pipes shall run exposed or concealed as shown on drawings and where enbedded in walls / floors, the route of pipes shall be coordinated with other contractors and shall be submitted for the approval of the Project Manager.

All horizontal runs shall be given a slope of at least 1/4" for soft pipes and 1/8" for waste pipes and all vertical soil stacks shall extend to above the roof line unless otherwise specified. All vertical vent pipes will not have any angle or bend unless absolutely unavoidable, and pipes running exposed on wall/ceiling shall be properly clamped with hangers / supports / clamps. Wherever the pipe passes through masonry walls or structural members pipe sleeves shall beembeeded, properly caulked, and water proofed, in coordination with civil Contractor. All changes in pipe direction shall be made 45^0 wyes long / short sweep bends or equivalent fittings.

Clean outs shall be provided wherever pipe changes direction more than 45°, at 50 feet interval in horizontal runs of 4" dia. pipe, at tees at bottom of vertical stacks etc. and clean out plug of upto 4" shall be provided. All clean

outs shall be of the same size as the pipe, and all panels and plates for access to clean outs shall be provided, and the entire arrangement of clean outs shall be subject to the approval of the Project Manager.
The jointing material for C.I. Pipe shall be lead and the packing material shall be just or hemp. Before lead caulking the joints should be thoroughly cleaned and degreased. The lead used shall be pure and soft and shall be sufficiently heated to run the joint full at one pouring without hardening. After the joint has cooled, all joints shall be thoroughly caulked with oakum and pitch and smoothly finished. The amount of lead used shall not be less than 4 lbs. or to a depth of 1.75 inches whichever is more.

The reinforced concrete pipes shall run outside the building upto the trunk sewer, and shall be of class 'A' for underground burrial interenches excavated to required width and gradient. A through visual examination of RCC pipes stored at site shall be carried out before laying and defective and damaged pipe shall not be used. The trench bottom shall be shaped to give support to the bottom one fourth of pipe circumstance. The inside and outside surfaces of the pipes shall be cleaned with a brush to remove any oil foreign matter sticking to the pipe.
The pipe jointing shall be carried out by first placing spun yarn rope dipped in hot maxphalt compound between the ends of pipes and pressed together and the collar shall then be brought in the middle of the joint. To ensure the pipes and the collar to be concentric two to three wooden wedges shall be placed around the pipe which shall be removed immediately after the jointing is complete and the cavity thus left shall be filled with 1:1 cement sand mortar. "Bitumen soaked hemo or jute shall be placed on the joint and caulked in its correct position so as to occupy about one fourth of the collar width.

The remaining width shall then be filled completely with 1:1 cement sand mortar from both the ends and finished off around the joints at an angle of 45^0 with the barrel of the pipe. Some suitable swab or drag shall be kept in the pipe and shall be pulled past each joint immediately after the jointing is completed. The joint shall be kept protected from weather and cured for at least ten days and then tested in the presence of the Project Manager.
Whenever the sewerage line shall cross a water line, it shall be cast iron, steel, or other approved pressure pipe for at least 20 feet of its length. The joints in this pipe shall be at least 3 feet away on either side from the water line. Alternatively it shall be fully encased in correct of minimum 6" thickness if so specified by the Project Manager depending upon the location of the crossing.

2.4 TESTING

The entire plumbing works including the drains, waste and vent piping both inside and outside the building shall be subjected to water test. The test shall be made in accordance with the local requirements, and every section of the installation shall be tested under hydrostatic pressure from the lowest point to the highest point. The Contractor shall furnish all devices, materials, labour etc. required for conducting these tests the cost of which shall be deemed to be included in the bid price. All test shall be performed in the presence and to the satisfaction of the Project Manager and may be required to be carried out either during or after laying or both and the Contractor shall inform atleast 7 days in advance as to when the he intends to perform the required test. Any

leakage viable or loss of hydrostatic pressure beyond tolerence limits shall be considered a defect.

Defact disclosed by the test shall be replaced as required by the Project Manager and the test shall be repeated as directed until all works prove to be satisfactory.

The following test procedure shall be followed:

a. **Water Lines**

All water lines before covering up shall be tested hydraulically for which a test pump shall be utilised. An accurate pressure guage will be available on the pump and the installation shall be tested to a pressure of atl east 50 psi gauge higher than the normal operating mains pressure but not less than 150 psi gauge and all pipes. Specials, fittings, etc. and their joints shall remain watertight under full test head for two hours with no loss of pressure. The maximum tolerance shall be a leakage of 1 gallon/inch pipe dia/mile / 24 hours/100 ft. head.

b. **R.C.C. AND C.I. PIPES**

All RCC and CI pipes shall be subjected to water test before covering up or hauched with concrete for which a knuckle bend shall be temporarily jointed at the highest point the lowest point of the system shall be plugged as also the ends of connections and filled with water to a test head of at least 10 feet of water. The water supply shall be shut off and the test head shall be maintained for Two hours. The maximum tolerance shall be a leakage drop of 2 inches. In case of RCC pipes the water shall be added until absorption by pipes and joints has ceased. Slight sweating which is uniformly may be considered within tolerance limit, but any excessive sweating shall be considered as a defect.

3. PLUMBING FIXTURES

3.1 GENERAL

All plumbing fixtures shall be free from imperfactions and shall be true to sizes as specified with all joints water tight. All fixtures shall be supplied from one single manufacturer and shall have same colour and texture when installed in one bath room.

All fixtures / shall be made of virteous China to B.S.3402 of best quality burnt and glazed, non-absorbent and free from pores, having close grained homogenous mass. All fixtures in these specifications are of Swat Ceramics make or equivalent. The Contractor will obtain prior written permission from Project Manager for any deviation therefrom before submitting his bid.

All fittings, faucets, flush valves, traps, exposed piping , fixing screws etc. shall be made of gumetal or suitable alloys with chromum plating over nickle plate and finally polished. One sample of all fittings and fixtured shall be submitted at the outset to the Project Manager for approval, which shall be returned to him for installation when work is nearing completion.

3.2 WATER CLOSET (WESTERN TYPE)

The EC installed shall be best quality vitreous China free from aberrations or irregularities, with P or S trap, standard type 16" size, including solid plastic seat and cover having rubber buffers and hinges in specified colour, of Swat Ceramic ICL Bosh make as per Bill of Quantities or approved equivalent.

The Flushing Cistern shall also be of vitreous China coupled with the above specified W.C. and Swat Ceramics make ICL BOSH or approved equivalent as specified in the Bill of Quantities.

3.3 WATER CLOSET (ORIENTAL TYPE)

The WC installed should be of best quality vitreous China of matching colour, of specified capacity high level type with extended layer and flushing china, and including ball valve side inlet, internal overflow, plastic syphon ,plastic flush bend, brackets, and all ancillary material, of best quality local Swat Ceramics make or approved equivalent. All as per Bill of Quantities.

3.4 LAVATORY BASIN

The LB shall be of best quality viteous China free from aberrations or irregularities as per Bill of Quantities.

3.5 URINALS

The Urinal shall be of best quality vitreous China free from aberrations or irregularities as per Bill of Quantities.

3.6 KITCHEN SINK

The kitchen sink shall be of stainless steel, size 48"x18" and 9" deep as per Bill of Quantities.

3.7 TOWEL RAIL

The Towel rail shall be CP imported make as specified in the Bill of Quantities, with CP brass screws, and 3/4" dia. towel bar or approved equivalent.

3.8 MIRROR

The Mirror shall be imported Belgium make, size 18"x24" and 1/4" thick, with Four CP brass screws with cups, hard board backing and all ancillary material.

3.9 TOILET ROLL HOLDER

The toilet roll holder shall be chromium plated brackets with wooden removeable bar complete with fixing screws and all ancillary equipment of approved local make or as specified in the Bill of Quantities.

3.10 SHOWER

The shower shall be as per bill of quantities. The shower head will be CP of approved local make.

4. PLUMBING ACCESSORIES

4.1 GENERAL

The plumbing Contractor shall provide and install all plumbing accessories traps valves support hangers, etc. required to complete the work which will be shown on the shop drawings and approval thereof shall not relieve the Contractor from the responsibility of furnishing theses items of proper sizes and quantities. The work shall also include all protective , of 2 coats of approved paint on exposed sewerage lines out of which 1 coat shall applied before installation, and 1 coat of primer and 1 coat of enamel for all factory assembeled equipment in the factory, etc.

4.2 ACCESSORIES

Following plumbing accessories shall be furnished and installed as shown on drawings and specified here below:

a) **Piller Cocks**

Chromium plated brass, gunmetal or suitable alloy, self closing pillar cocks 1/2" size, with spray outlet CP handweel and having minimum clearance of 3" between centre lines of the handwheel and outlet. Locally made pillar cock of above specifications of MASTER make shall be installed if so specified.

b) **Hot/Cold Basin Mixer**

Chromium plated brass gunmetal or suitable alloy, self closing hot and cold monoblock mixer unit 1/2" size with spray outlet, suitable for one centre taphole basins, having minimum clearance of 3" between centre lines of the handwheel and outlet. Locally made mixer units of above specifications of MASTER make shall be installed if so specified.

c) **Hot/Cold Sink Mixer**

Chromium plated brass or gunmetal or suitable alloy, hot and cold mixer unit 1/2" size including drilling of suitable holes in Sink at 7-1/2" c/c/, with swivel nozzle projecting 7-1/2". Local make mixer units of above specifications of MASTER may be installed if so specified.

d) **Sink Basin Coupling**

Chromium plated heavy duty brass, gunmetal or suitable alloy coupling of 1-1/4" size for washbasin and 1-1/2" size for kitchen sink, with link chain waste and rubber plug having CP grio knobs, slotted tail land bolt stay of Shanks model 70017 NI and 70038 P2 respectively, or approved equivalent. Locally made coupling of above dimensions of ASIA make or approved equivalent. Locally made coupling of above dimensions of MASTER make or approved equivalent shall be installed if so specified.

e) **Faucets**

Chrome plated brass, gunmetal or suitable alloy, heavy duty concealed type bath room taps 1/2" size, with CP handwheel, and having 1/2" wall mount for concealed plumbing with extension piece handwheel matching other pillar cockds or mixer units of Shanks model 806041 A or approved equivalent. Local bib cocks of MASTER make shall be installed if so specified.

f) **Shower Mixer Valves**

Chrome plated brass of gunmetal thermostatic shower mixer valves 1/2" size concealed incorporating shut off and temperature control, with CP handwheel matching those of washbasin etc. of Shanks model 60464 AH or approved equivalent locally made shower mixer of above specifications of MASTER make shall be installed if so specified.

g) **Gate Valves**

These shall be full way brass or gunmetal with painted front handwheel having gland packing in stuffing boxes, either socketed or flanged in water lines, including masonry chamber where required, and all ancillary material of MASTER make or approved equivalent.

h) **Manhole Frames & Covers**

These shall be heavy duty type of cast iron spun pipe free from air bubbles or sand holes, of sizes as specified in the Bill of Quantities of TEEPU or ALPINE make or approved equivalent.

I) **Miscellaneous**

All sundry materials required for the completness of the plumbing installation and not specifically mentioned herein above and the cost of which shall be deemed to be included in the relevant item of the Bill of Quantities, shall be of the best quality procured from manufacturers of repute and shall be subject to the approval of the Project Manager.

4.3 **TRAPS**

All traps in the entire installation shall give a minimum 2" seal and shall be of the same material and finish as the pipe in which they are fitted. The traps in the system shall comprise following types as specified on the drawings.

a) **Floor Traps**

Cast iron floor traps of 4" size of TEEPU or ALPINE brand including concrete chamber around the trap, chromium plated grating and all ancilliary material. The GP grating under basins or urinals shall have centre hole to accommodate 1-1/4" dia. waste pipe.

b) **Bottle Trap**

Chromium plated bottle trap of brass, gunmetal or suitable alloy of 1-1/4" size for washbasins and urinals and 1-1/2" size for kitchen sink, with nit and rings for inlet and outlet etc. with removeable sump, of Shanks model 70197 04 and 70198 04 respectively, or approved equivalent.

c) **Gully Trap**

Cast iron gully trap shall have masonry chamber 9"x9" with CI grating properly grouted therein, with inlet connection below the grating and a 4" dia. C.I. Manhole cover with frame.

d) **Grease Trap**

Cast iron grease trap shall haje masonry chamber 12"x12" with inlet and outlet of 2"x3" dia. C.I. respectively, both having C.I. Tees inside the trap and a 10" dia. C.I. Manhole cover with frame.

4.4 **ELECTRICAL WATER COOLER**

Pressure type water cooler shall have 20 SWG MS cabinet painted inside with non-corrosive pain and outside with specified colour rustfree, with pilot lamp, suitable for operation at 220/240 Volts 50 Hz system, having hermeti cooling tank of spevidies capacity thoroughly insulated with fibre-glass, stainless steel water pan having glass filler attachment, and capable of delivering cold water at 4°C to 12°C. The cooler shall have a 1/2" dia. C.I. Pipe inlet and outlet, and shall be of MECO make or approved equivalent.

4.5 **G.I. & C.I, PIPES**

Notwithstanding stipulation in any other part of this tender the steel pipe for gas and water supply used in the project shall be that manufactured by Pioneer Steel Mills Ltd., Lahore and International Karachi Pipe Mill. Similarly the cost iron pipe used in the project shall be Spun C.I. Pipe manufactured by TEEPU or ALPINE and all contractors are advised to base their rates accordingly.

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT AND MANAGEMENT COMPANY (PIEDMC) HEAD OFFICE AT LAHORE

TECHNICAL SPECIFICATIONS FOR ELECTRICAL WORKS

INTERNATIONAL ENGINEERS
Chartered Electrical Engineers & Consultants
A/1 Sea Breeze Homes, Sher Shah Block New Garden Town Lahore, Pakistan.
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TECHNICAL SPECIFICATIONS OF ELECTRICAL WORKS
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SECTION -1 TECHNICAL PROVISIONS

TP.1 GENERAL.

The general instructions are given to the tenderers elsewhere in this contract document. The additional instructions in the following paragraphs are given in order to invite the tenderer's attention towards some major points pertaining to electrical work only and to assist them in preparing tenders. These instructions shall be deemed as Technical provisions of the Contract.

TP.2 SCOPE OF WORK.

The work consists of furnishing all tools, plants, labour, materials and equipment and performing the internal and external electrical works comprising of the following or as specified in B.O.Q.

SECTION - A	H.T. Switchgear & Transformer.
SECTION - B	L.T. Switchgear Main Panel Board and DB's.
SECTION - C	Internal Wiring Concealed with PVC Conduit.
SECTION - D	Fitting & Fixtures.
SECTION - E	Cables, Conduits, Cable Trays & Rising Mains.
SECTION - F	Emergency Diesel Generating Set.
SECTION - G	Voice Data Systems.
SECTION - H	Fire Alarm System.
SECTION - I	M.A.T.V System.
SECTION - J	Music & Paging System.
SECTION - K	Lightning Protection System.
SECTION - L	Earthing System
SECTION - M	Closed Circuit Television System.
SECTION - N	Miscellaneous Items.

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The work shall be carried out in strict accordance with the conditions of contract, special conditions, Drawings, Technical Specifications, in coordination with other contractors on this project and as per items of Bill of Quantities and including the responsibility of all related works necessary for their proper functioning, testing, commissioning and satisfactory operation and performance including maintenance for the period specified elsewhere. The contractor shall provide for all required technical non-technical personnel, skilled and non-skilled labour, construction equipment, transportation etc., as required for the completion of works in strict accordance with the Technical specifications laid here-in after.

TP.3 CONTRACTOR'S QUALIFICATION.

The Electrification work shall be carried out only by a licensed Contractor authorized to undertake such work under the provisions of the Electricity Act, 1910, and the Electricity Rules, 1937, as adopted and modified by the Government of Pakistan.

TP.4 This licensed Electrical Contractor shall have the following qualifications.

a. Must have in his employment a competent graduate Electrical Engineer registered with Pakistan Engineering Council, Islamabad.

b. Must possess a valid Electrical licence issued by the Electrical Inspector of Islamabad region.

c. Must have in its employment an Electrical Supervisor having certificate of competency who will exclusively look after this work.

d. Must have necessary tools, plant and instruments.

e. Must have adequate experience of similar works.

TP.5 **RULES AND REGULATIONS**

The installation in general shall be carried out in conformity with the Electricity Rules, 1937, and the latest edition of the Regulations for the electrical equipment of buildings issued by the Institution of Electrical Engineers London (I.E.E.) However, in case of conflict between these specifications and the I.E.E. Regulations, these specifications supercede IEE regulation.

TP.6 **STANDARDS**

The latest relevant British specifications and codes, Pakistan Standard Specifications, VDE, I.E.C. and I.E.E. recommendations shall be applicable and be followed for the equipment specified herein.

TP.7 **CLIMATIC CONDITIONS**

All equipment supplied shall withstand, without developing any defect, the following climatic conditions.

Maximum Ambient Temperature	=	120^{O}F or 49^{O}C
Minimum Ambient Temperature	=	28^{O}F or (-)2.2^{O}C
Maximum Humidity	=	90 %

TP.8 **SPECIFICATIONS**

The contractor shall furnish all material and equipment at site, conforming fully to the specifications given herein and to the accepted standards as laid down by British Standards, the Institution of Electrical Engineers, London, and the Pakistan Standard Institution. It is not the intent of these specifications to include all details of design and construction of various material and equipment to be supplied under this contract. The Contractor shall supply and install all material and equipment specified herein and also all installation and small material such as nuts, bolts, washers, shims, angles, leveling material, installation as covered by the specifications.

All material and equipment supplied by the Contractor shall be new and in all respects conform to the high standard of engineering design and workmanship, perform and function as herein specified and fully meet the quality level and ruggedness requirement of the specifications. All material and equipment which have to be supplied and installed by the Contractor shall be passed / approved by the Engineer; even if the same is exactly in accordance with the Bill of Quantities and drawings.

TP.9 **SUBMITTAL**

The contractor, after the award of work, shall submit for approval of the Engineer all drawings and Catalogues of equipment, appliances, fixtures and accessories that are to be furnished under the contract. After final approval of a sufficient number of copies as desired shall be furnished for distribution. Catalogues and drawings shall be clearly marked to indicate, the items furnished. Catalogues of all fixtures, and not a few, shall be submitted.

TP.10 **APPROVAL OF DRAWINGS AND DATA**

The Contractor shall provide detailed electrical drawings, wiring diagrams, foundation details, etc., for all electrical switchgear, fusegear and all other systems etc., for the Engineer's review for obtaining approval.

The manufacturing of electrical equipment shall be started only after the above mentioned drawings and data are approved.

The time required for review and approval shall be considered included in the total time of completion of job.

TP.11 **DRAWINGS AND DATA**

Three sets of drawings and data for each equipment shall be furnished by the Contractor for the Engineer's approval before commencement of fabrication and manufacture which would start only after that approval. The drawings to be supplied by the Contractor shall be as follows:-

- Arrangements.
- Dimensional Plans, elevations and front view.
- Foundation Plan, anchors and configuration.
- Incoming and outgoing cable termination positions.
- Earthing arrangement.

Electrical Drawings showing.

- One-Line diagram.
- Detailed wiring diagram.
- All interconnections.
- Instrument transformers.
- Relays, their locations and internal wiring diagrams.
- Other electrical devices including meters instruments and their wiring diagram.
- Signal and alarm circuit.

TP.12 **SHOP DRAWINGS**

The design drawings show approximate conduit routes and depict only the position of various fixtures and outlets. All the actual planning for the conduit routes shall be carried out, well in advance of the actual execution of work, by the Contractor to the satisfaction of the Engineer. For this purpose the Contractor shall prepare shop drawings and obtain prior approval of the Engineer. Three prints of each shop drawings shall be submitted for obtaining approval.

No piece of work shall be allowed to be executed at site without the availability of these approved shop drawings. These shop drawings shall clearly depict the load balancing chart of each distribution board. Time required for the preparation and approval of shop drawings shall be considered to have been included in the total time allowed for the completion of the work.

TP.13 **SETTING OUT OF WORK**

The Contractor shall set out the work himself and if any discrepancy is found, he shall report the matter to the Engineer and shall act as directed. If any defective or modified setting out is carried out by the Contractor on his own, he shall rectify or make it good at his own cost.

TP.14 **PROGRAMMING**

The contractor shall keep pace with the work of the Civil Contractor and any other specialist contractor . The engineer shall be kept informed about the programme and the progress of work so that there is no hindrance in the execution of work at site.

TP.15 **PROTECTION**

The contractor shall take care not to damage the structure , material, equipment and property belonging to and/or installed by other contractors during execution of work and shall repair and make-good all losses at his own cost, if found damaged in the opinion of the Engineer.

TP.16 **CHANGE OF SPECIFICATIONS.**

No change in specification of the equipment / material will be allowed at any stage, except with the prior approval of the Engineer before the opening of Tenders.

TP.17 **PURCHASE OF EQUIPMENT / MATERIAL.**

All the equipment and material e.g. transformers, switchgear, cables, conduits, light fixtures and fans etc. will be purchased direct from the manufacturer. Certificate and copies of delivery challans for all such material will be produced as and when desired.

TP.18 **MANUFACTURERS AND BRANDS.**

Where brands and names of Sub-Station equipment or any other system are specified by name, alternative can be offered provided these are equal in quality to those specified. Satisfaction of the Engineer in this respect shall be essential and prior approval for such deviation shall have to be obtained before submission of Tenderers. However all equipment for substation or system shall be from one manufacturer only.

TP.19 **FACTORY TESTS**

All routine and type tests on HT LT switchgear (ACBs,MCCBs , Relays , Magnetic Contactors , PFI Equipment and Enclosures),HT & LT cables , Emergency Diesel Generating Sets and other equipment shall be performed at the manufactures facility or at a recognized independent test laboratory in the presence of the “Engineer” as per applicable international standards .The term “Engineer” henceforth in the rest of the technical specification of electrical works shall mean an assigned, qualified electrical engineer of Client and Consultant. The presence of both engineers shall be ensured at all times during factory tests and inspection. The contractor shall be allowed to supply equipment to site only after successful and satisfactory testing and inspection at factory / laboratory with 3 copies each of test reports dully issued to be maintained in client’s and consultant’s record. The contractor shall inform the engineer about the date and time of tests on each equipment at least two weeks in advance. The witnessing of tests by the engineer shall not absolve the contractor of his responsibility for proper functioning of the equipment , and for furnishing the guarantee. Contractor shall at its own expense make all arrangement of transportation loading etc for the engineer, without any claim of addition charge or cost to the client for tests and inspection.

TP.20 **OWNER'S SUPPLIED MATERIAL.**

Material and equipment if supplied by the Owner shall be made available at site store to the contractor for installation. Any lead and lift upto and within the site of work shall be at the cost and responsibility of the Contractor . The contractor shall ensure safe handling and proper protection after the material and equipment are issued to him at site store and shall provide and maintain required plant and equipment for handling, proper protection and installation at his own cost.

TP.21 **SPARE PARTS LIST**

A list of spare parts required for one year's operation of each equipment where deemed necessary “except OFM” together with unit price of each part, shall be supplied by the contractor.

TP.22 **GUARANTEE**

The contractor shall furnish written guarantee, in triplicate, of the manufacturer for successful performance of each equipment. Such guarantee shall be of material and / or workmanship. The guarantee shall cover a minimum period of 12 months effective from the date of completion certificate.

TP.23 **AS-BUILT DRAWINGS.**

The contractor shall, during the progress of work keep a careful record of all changes and revisions where the actual installation differs from that shown on shop drawings. These changes and revisions shall be accurately carried out on the shop drawings and submitted to

the Engineer for approval. After approval these drawings shall become the property of the Owner. These updated and approved shop drawings depicting clearly As-Built drawings shall be submitted to the Engineer. Reproducible tracings of all these As-Built drawings shall be handed over to the Engineer. Final payment will be withheld until the receipt of the approved As-Built Drawings.

TP.24 **TEST REPORTS.**

The contractor shall be responsible for submitting the test reports/ certificates and get the installation inspected / passed by the Regional Electric Inspector at his own cost.

TP.25 **LESCO REQUIREMENT.**

The contractor shall assist the Owner in sponsoring application for Electrical Connection, with LESCO and carry out necessary formalities. Any special requirement of LESCO shall be complied with by the contractor. The Owner shall arrange to deposit all amounts, on demand, to LESCO for providing service connection and security deposits thereof.

TP.26 **T & T REQUIREMENT.**

For the supply, installation and regularization of Telephone system, the contractor shall obtain N.O.C. from Director General, T&T Department, Ministry of Communications, Govt. of Pakistan, Islamabad if required. Any special requirement of the T&T Department shall be complied with by the Contractor . The Owner shall arrange to deposit all amounts on demand from T&T Department for obtaining telephone connections to public Exchange and security deposits etc.

SECTION - 2 PVC CONDUITS AND ACCESSORIES

PVC.1 **CONDUIT PIPE**

The conduit for wiring of circuits, lights, socket outlets and other systems shall be made of PVC manufactured under the trade names of "Polo" or “Popular” conforming to BS6099.

Steel conduit shall conform to BSS 31/latest and shall be 'International', Hilal and/or Premier "brands. The conduit shall be enameled with good quality non-cracking and non-flaking black paint.

PVC.2 **FLEXIBLE PIPE**

Flexible conduit shall be furnished and installed where necessary for convenient dismantling and/or avoiding vibrations to be transmitted. Flexible conduit shall be spiral interlocked type made of steel strip construction and coated with zinc or chromium plated.

PVC.3 **CONDUIT ACCESSORIES.**

Factory made round PVC. junction boxes shall be installed with non pressure type Pvc conduits. Junction boxes shall be of 2-1/4" dia and 3" long to receive Pvc conduit and shall be concealed in RCC of slab. The wall type junction box shall also be factory made round PVC boxes having minimum dimentions of 2-1/4" dia and not less than 1-1/4" long. Each juntion box shall be provided with one piece cover which shall be fitted on the box with chromium plated screws.

3.1 Conduit accessories such as switch boxes, socket outlet boxes, pull boxes and inspection boxes shall be made of 16 SWG sheet steel having dust tight covers. All boxes shall have required number of conduit entry holes and earth terminals for connecting E.C.P. All the rectangular or square shaped boxes shall have nipples to receive PVC conduit with force fit. All these boxes shall be painted inside and outside with black enamel, over a base coat of red oxide antirust paint. Shapes and sizes of these boxes shall be determined on each application.

3.2 Manufactured smooth bends shall be used where conduit changes direction. Bending of conduit by heating or otherwise shall be allowed only at special situations with the permission of the Engineer. Use of shape 90 degree bends and Tees is prohibited. Bends shall have enlarged ends to receive the conduit without any deduction in the internal diameter of the PVC pipe.

3.3 All accessories e.g. boxes, couplings, bends , solid plugs, bushes, reducers, checknuts etc. shall be equal in quality to the specified conduit.

3.4 Where inspection boxes occur in floor slabs a special cover on the box shall be installed to the satisfaction of the Engineer.

3.5 The use of looping in box shall be allowed in places where floor slab thickness permits 90 degree bends in conduit.

PVC.4 **INSTALLATION INSTRUCTIONS.**

The contractor shall furnish all labour and material for the installation of conduit as required.

4.1 Conduit shall be installed concealed in RCC ceiling slabs, columns, walls and floors etc., Recessed conduit shall be laid over the first tier of reinforcement and under the second tier of reinforcement before pouring of concrete. All conduit outlet boxes to be concealed shall be laid firmly flush with the soffit of the slab or beam. The conduit should be tied to the reinforcement firmly so that the alignment is not disturbed by vibrators. All the outlet boxes installed shall be stuffed and their cover plates fixed so as to prevent concrete entering the outlet boxes.

4.2 Under no circumstances shall chasis be made for recessing conduit in the RCC structure after it has been cast without the permission of the Engineer. Where conduits have to be concealed in cement concrete or brick masonry, chasis shall be made with appropriate tools not deeper than required. The conduit shall then be fixed in the chasis with iron hooks before covering it up with at least 20mm thick plaster. Conduit ends pointing upward shall be properly sealed to avoid entry of foreign material.

4.3 The drawings show conduit routes but planning for proper arranging conduit routes shall be carried out by the contractor to the satisfaction of the Engineer.

4.4 The entire conduit system shall be essentially completed before the wire pulling is taken in hand. Each conduit run shall be tested for continuity and obstructions. All obstructions shall be cleared in an approved manner. Water and moisture that has entered any section of the conduit installation must be dried with suitable swabs to the satisfaction of the Engineer.

4.5 Adequate expansion joints shall be provided in all conduit runs passing across the expansion joints in the concrete slabs of the buildings. A typical arrangement is shown on drawing.

4.6 Pull boxes shall be installed in conduit runs at intervals mentioned below to facilities the pulling length of wires:-

i)	Straight runs.	-	20 meter.
ii)	Runs with one 90 degrees bends.	-	15 meter.
iii)	Runs with two 90 degrees bends.	-	10 meter.

4.7 Conduit runs between two outlets shall not contain more than two quarter bends or one 90 degree bend.

4.8 All the free ends of conduit shall be solidly plugged till such time as final and proper terminations are made.

4.9 All conduits of a system shall be run at least 6" away from the other systems and services where conduit of one system crosses the other it shall be done so at right angle i.e. 90 degree.

4.10 All multiple runs of conduit shall be arranged symmetrically.

4.11 Exposed runs of conduit where required shall be firmly held by means of G.I. saddles, clamps and brackets etc., to the surfaces of walls, columns and ceiling . Rawal plugs or phil plugs may be used for fixing saddles, clamps and brackets etc. The spacing between two saddles may not be more than 30". The straight runs on walls may be 18" to 24" below the ceiling and in the event of any obstruction due to beams the runs may be routed them. The conduit shall have a minimum clearance of 6 mm from the surface supporting

it. Purpose made special clips and brackets may be required at some situations to support the conduit.

4.12 No conduit less than 20mm dia. shall be used for point wiring and 25mm dia. for power wiring. The size of conduit shall however be determined from the number of wires required in the conduit run according to number of wires allowed as per IEE Regulations.

4.13 Use appropriate size sleeves for crossing of beams lintales retarding walls etc. for providing conduits / cables at later stage.

PVC.5 **MEASUREMENT**

5.1 All conduit work including all accessories shall be measured on the basis of actual numbers of circuit, light points, fan points, call bell points and/or 5A or 13/15 A socket outlet points installed as shown on drawings, or as specified in the B.O.Q.

5.2 For other systems the conduit work shall be on actual measurement basis on the running length installed in feet or meters as the case may be or as specified in B.O.Q.

SECTION - 3 WIRES, CABLES AND CORDS.

WCC.1 **WIRES & CORDS.**

The wires & cords for conduit wiring shall be single core, made of stranded copper conductors, PVC insulated, tested to B.S. 6004, 1975. The voltage grade shall be 300/500 volts or 450/750 V unless otherwise specified on drawings and Bill of Quantities. The cables shall be of M/s. Pakistan Cables Limited, M/s. PIONEER Cable, M/s. Newage Cables.

In order of preference as approved by the Engineer. The size of the wire shall be as follows:

i) for light or fan point wiring with 1.5MM square (or 3./029) or as specified in the B.O.Q.

ii) for light circuit wiring with 2.5MM square (or 7/0.29) or as specified in the B.O.Q.

iii) for power plug 15A wiring with 4 MM square (or 7/.036) or as specified in the B.O.Q.

iv) the sizes of cables from Main Panel Board to Sub-Main Panel board to distribution baords shall be as shown on drawings or as specified in BOQ.

WCC.2 **INSTALLATION INSTRUCTIONS.**

2.1 The contractor shall furnish all material and labour to pull in and install wires and cables as required. The contractor shall also supply, without extra cost, wire accessories e.g. plugs, solder, clamps, supports, bushes, fixing pins, adhesive tapes, connectors, identification tags, straps, filling compound and earthing clips etc. as are required to be furnishedfor complete wiring installation in accordance with standard practice. The pulling of wires shall be taken in hand only when all conduit system is complete. All termination shall be mechanically strain free and electrically sound.

2.2 The wiring of the installation shall be strictly in accordance with the scheme, cable sizes and circuit details as shown on drawings and specified in WCC.1

2.3 All wiring shall be continuous between terminations and use ofconnectors or joints disallowed. Spur and Tee connections are strictly prohibited. Looping in system shall be followed throughout.

2.4 Manufacturers recommended lubricant shall be allowed to facilitate pulling of wires, use of all other kind of oil and soap is prohibited.

2.5 All wires occupying the same conduit shall be pulled together. Wires and cords at the time of pulling shall not be subjected to a bending radius more than 10 times the over all diameter of cables. Cable manufacturers recommendation of pulling speed and pulling tension on cables shall govern the pulling operation.

2.6 Not more than 2 circuit wires shall be bunched in the same conduit. Wires of two different phase, however, shall not be run or terminated in the same outlet box for single phase wiring of lights, switches and sockets.

2.7 Porcelain or moulded plastic connectors shall be provided for a joint between light point wiring and light fixture wiring and housed in the outlet box provided for this purpose. The contactor after terminations are made shall be wrapped in PVC insulation tape.

2.8 The quantity and the size of the wire contained in any one conduit shall not be in excess of the numbers permitted by I.E.E. regulations.

2.9 All point and circuits wiring shall be solidly earthed by 14SWG (2.5mm square) PVC insulated wire of colour Green, Yellow to serve as CPC which shall be run inside the conduit.

2.10 All 5A & 15A socket shall be wired separately direct from D.B. without any claim of circuit and distinctly from light point wiring, or as specified in B.O.Q. However 5 Amps socket shall be controlled by D.B, or as specified in B.O.Q.

WCC.3 **MEASUREMENT.**

Similar to PVC conduit - Section PVC.5

SECTION - 4 WIRING ACCESSORIES.

WA.1 SWITCHES.

1.1 Indoor switches controlling lights and fans shall be single pole, 10A, one or two way, suitable for 250V, 50Hz. The body of the switches shall be made of moulded plastic, one, two, three, four or six gang with integral built in moulded plastic face plate suitable for fixing on a sheet steel outlet box. The switch contacts shall be silver alloy tipped and these shall operate with snapaction. The switches shall be piano type, ivory white in colour and made by CLIPSAL/Legrand. The switches shall conform with BSS 800.

1.2 Weather proof switches on external lighting circuits shall be rotary type with quick make quick break action rated 5/10 Amps, 250 V, 50 Hz.

WA.2 SWITCH SOCKET OUTLET UNITS.

2.1 Switch and socket units shall be single pole, 3 pin rated 13A or 15A, 250V, 50 Hz. These shall be moulded plastic type with ivory white integral built-in face plate. Each socket shall have its control switch by the side of it on a common face plate. Thus the complete unit specified in BOQ shall be as switch and a socket outlet unit. The switch socket outlet unit shall comply with BSS 546 and BSS 5733 or BSS 3052. Bells / chimes/Buzzers and bell pushes shall be suitable for operation on 230 Volts and made by Legrand / CLIPSAL.

2.2 Weather proof switch units shall have a cast iron outlet box with threaded conduit entry holes or nipples,rubber gasket and a spring loaded sheet steel cover.

2.3 Ceiling roses shall conform to BSS 67/1969. Lamp batten holders shall conform to BSS 5042 Part-I.

WA.3 INSTALLATION INSTRUCTIONS.

All the switches and switch socket outlet units shall be installed on 16 SWG thick sheet steel outlet boxes of appropriate sizes All sheet steel boxes shall have conduit entry and terminals for connecting 14 SWG or 2.5mm (sq) PVC insulated circuit protective conductors.(CPC)

WA.4 MEASUREMENT.

The number of units installed shall be taken as the basis of measurement or as specified in the BOQ.

SECTION - 5 POINT WIRING , CIRCUIT WIRING AND SOCKET OUTLET WIRING

W.1 **GENERAL.**

The work included under this Section consists of furnishing all labour , material, services and skilled supervision necessary for the construction, erection, installation and connection of all circuits and equipment specified herein or shown on the drawings and / or normally required for an installation of this type including but not limited to testing of the installation and its handing over to the Owners. The extent of work specified herein and/or shown on the drawing represent the minimum requirements. The installation on the whole should conform to the best form of workmanship and shall be accomplished by workmen, licensed and skilled in this type of work.

W.2 **MEASUREMENT.**

2.1 **POINT WIRING.**

For the purpose of measurement of light / fan point wiring the following work shall be deemed to constitute the work of a point wiring:-

a) Providing and fixing conduit from a switch to wall / column / ceiling outlet, or fan / fixture excluding final sub-circuit conduit from distribution board to the switch as described in section 2 or as specified in B.O.Q.

b) Providing and pulling of wires from switch to fan / fixture outlet excluding providing and pulling of final sub-circuit wiring in the conduit laid as in (a) above and as described in Section 3 or as specified in B.O.Q.

2.2 **SOCKET OUTLET WIRING.**

a) For 5A socket on the light switch board and also away from the board the basis of the measurement shall be the same as in section 2.1.

b) For 13A/15A socket outlets the work shall comprise as under:-

i) Providing and fixing conduit from distribution board to the socket outlet as described in section 2

ii) Providing and pulling of wires in the conduit as in (a) above as described in section 3

2.3 **CALL BELL POINT WIRING.**

This shall be identical to section W.1 i.e. wiring for light point or as specified in B.O.Q.

SECTION - 6 LIGHT FIXTURES

LF.1 GENERAL

Light fixture schedule is provided in the drawings alongwith catalogue numbers of the manufacturers which are meant to serve as illustrations of the types of fixtures required for various applications.

The contractor shall be required to submit samples of each and every light fixture for the approval of the Engineer, before commencing with mass production of the fixtures. The contractor should be prepared to carry out any number of modifications and improvements in the submitted sample free of cost until a finally acceptable sample is produced. Mass production shall be taken in hand only after a finished and modified sample has been produced and approved in writing by the Engineer. The contractor has the option to offer acceptable equivalent of the specified light fixtures but to be installed with prior approval from Engineer.

LF.2 LED LIGHT FIXTURES

The LED lights fixtures shall be down lighters/light panels/floods lights as shown in drawings and given in BOQ. These will be surface mounted or recessed in false ceiling as per requirement of the project. The light fittings shall be CE & ROHS approved according to ambient temperature comprising of LED's of having life span of more than 60,000 hour.

LF.3 LED & DRIVER

LED shall be class-I having at least 100 lumens/Watt and make of CREE/EPISTAR/BRIDGLUX or approved equivalent. Driver unit having tolerance range of 85V to 285V with surge protection device, total harmonic distortion should be less than 20%. The driver should be MEANWELL or approved equivalent.

LF.4 EMERGENCY LIGHTING

Emergency light fixtures shall be of the self-contained 3-hour maintained/non-maintained type, as specified, with 8 watt high efficiency fluorescent lamp and prismatic diffuser, with maintenance-free NiCad batteries, separate baseplate, plug-in luminaries with locking screw. The emergency output shall typically be 180 lumens.

Exit sign and other legends, which shall be chosen and approved by the Engineer, shall be to BS formats, 180mm or 90mm high, as required.

Converter systems shall be of the type suitable for mounting within luminaries, to convert an ordinary fluorescent luminaries into a self-contained battery-powered emergency luminaries. The emergency output shall typically be 600 lumens minimum.

LF.5 INSTALLATION INSTRUCTIONS.

5.1 The light fittings shall be installed according to manufacturers recommendations or as approved by the Engineer.

5.2 Flexible connecting wires from outlet box to the fixture shall be provided by the Contractor; connector made of porcelain or thermoplastic material shall be provided and installed in the outlet boxes for connecting flexible wires to the point wires.

5.3 Outlet boxes or any openings in the ceilings or walls shall be covered with appropriately fabricated accessories to provide an architectural entity to conceal them.

5.4 Rawal plugs or nylon plugs with good screws shall be used for fixing purposes.

LF.6 **MEASUREMENT.**

Actual number of units installed shall be taken as the basis for measurement or as specified in BOQ.

SECTION - 7 POWER CABLES

PC.1 **GENERAL.**

Power cables conforming to these specifications, described in the B.O.Q. and as shown on drawings shall be supplied, tested and installed. The cables shall be manufactured as specified hereunder.

a) Material aluminum or copper conductor, armored or unarmored single or multi core as indicated in the Bill of Quantities and shown on drawings.

i) **Wiring Cables, 300/500 Volts.**

Wiring cables shall be single core colour red black or green 300/500 volts grade copper conductor complying with ESS 6006, 1975.

ii) **Unarmoured Power Cables 600/1000 Volts.**

The PVC insulated cables shall be 4 core, 600/1000 PVC insulated and PVC sheathed. The thickness of PVC insulation and sheath shall conform to BS 6746, 1976 and manufactured in accordance with BS 6346, 69.

iii) **Armored Power Cables 600/1000 Volts.**

The PVC insulated cables shall have a number of cores as shown on drawings and in the bill of quantities and should be taped, wire armored and extended PVC sheathed overall, manufactured in accordance with BS 6346 and 6346,69.

iv) **Copper Conductor Cables.**

The conductor shall be stranded plain annealed copper wire of high conductivity complying with BS 6360,69.

v) Aluminum Conductor shall be stranded complying with BS 6791, 1960.

vi) Cable Termination's:

All PVC cables shall terminate in approved pattern metal boxes fitted with suitable glands for securing the armor wires and incorporating a packing ring for exclusion of water and moisture. The cables shall be secured at the requisite spacing by means of cable cleats or hangers and where multiple runs occur, they shall be accommodated on heavy gauge galvanized perforated metal tray.

The cores of multi-core cable shall coloured in conformity with the BS Specifications in order to provide easy identification. Each cable core shall be seated solid at the midway point in the box and the cores then continued to the terminals of the equipment. These cores shall be insulated by sufficient layers of empire tape for the voltage concerned.

Boxes shall be thoroughly clean and dry prior to filling with compound of the best quality. Boxes shall be finally topped up to make up any voids caused by shrinkage of compound.

b) **Instructions for Laying LT Cables.**

i) The cables sizes are specified to accord with the IEE Regulations in respect of voltage drop, but if for any reason the sizes are not given for a particular run the cable shall be of sufficient cross- sectional area to carry the full load without

exceeding a voltage drop of 1 volt plus 2% of the supply authority declared voltage between the main service termination and any part of the installation, except that in the case of motors running under normal condition the permissible maximum voltage drop at the motor terminals is 7.5 % of the declared supply voltage.

ii) The depth of the trenches shall be such that top surface or the cable shall not be less than 900 mm from the finished ground level, it will be contractor's responsibility to obtain trench levels for this purpose.

iii) Indicated routes shall be followed for excavating trenches unless otherwise specified where change of direction is necessary the radius of the bend may not be less than twice the diameter of the cable drum or 20 times the diameter of the cable whichever is greater.

iv) At cross roads the cables shall pass through 150 mm dia asbestos / R.C.C. pipes, The mouth of which shall be sealed after drawing the cables. The Contractor shall provide the conduit at no extra cost to the Owner.

v) The road cuts shall be filled first with mud 60 mm ballast up to 150 mm below the road level and after consolidating it properly 150 mm of concrete in cement shall be laid over it.

vi) The cushion of sand to be provided must not be less than 225 mm deep i.e. 75 mm below and 150 mm above the cable. Over the final layer of sand, cable marking tiles/ bricks 2" thick and 300 x 150 mm size of approved make shall be placed end to end along with the whole length of the cable. The rest of the trench shall be filled up with earth which will be rammed layers of 150 mm each.

vii) No trenches shall be dug or holes shall be left unprotected in the open state at any time and for any length of time without completing the job and refilling them in satisfactory manner.

vii) Where trenches are left open by oversight and where roads are being cut in the day or night the contractor shall exhibit suitable danger signals, such as banners, red flags and red lamps at his own cost.

ix) All the trenches shall be watered and rammed properly before final dressing. The same applies to lawns but here in place of cement filling some manure of good quality shall be utilized. The turf shall be carefully rammed and preserved in a convenient place by filling up, watering and maturing is complete.

x) One end of the cable shall be terminated or respective switch board and other end shall be terminated on meter board in case or service connector or at respective connection point as indicated in the drawings.

SECTION – 8
EMERGENCY DEISEL GENERATOR SET

EDGS.1
GENERAL

The contractor is under obligation in providing materials, equipment and accessories and providing skilled labour, Technical (Generator Installation) supervision and experience in carrying out all necessary works for the complete execution of the emergency supply system specified hereinafter, as shown on drawings and listed in schedule and which, without excluding the generality of the foregoing, shall include but not be limited to the following scope of work. The specifications relates to the design, manufacture and works testing of a fully automatic mains failure diesel generating system.

EDGS.2
SCOPE OF WORK

This system shall provide an alternative source of supply to essential lights and equipment in the event of LESCO supply failure. This system shall comprise of Diesel Generating set feeding through Automatic Main's Failure control panel to emergency supplied Main L.T. switch board all housed at Basement. This Main L.T. Switch board shall be connected, through suitably rated feeder cables, to emergency supply sub main switch boards and/or distribution of each floor of buildings.

The LESCO supply shall be monitored and in the event of its failure shall 'start' the generating set automatically and deliver 90% load in 15 seconds. On the restoration of LESCO supplies, the D/G set shall stop automatically in 3-15 minutes (adjustable).

The sets shall be manufactured by any one of the manufacturers as mentioned in Annexure "B". The Contractor shall provide sufficient technical details and data to establish the suitability of the offered D/G set in accordance with the minimum requirements laid down hereunder. The contractor should provide certificates from the Gene-set manufacturer that the Gen-set supplied is brand new/unused and the manufacturer has arrangements of providing after sale services and parts through his distributors or his own sources. Incase the supplier / contractor installs used / second hand Gene-set, it shall be rejected without any claim whatsoever and the rejected equipment shall be replaced / installed at the cost of the Contractor.

EDGS.3
SCOPE OF EQUIPMENT SUPPLIES

Standard Diesel Generating sets supplied shall consist of the following:

3.1 **Diesel Engine**

Complete Industrial Diesel Engine Turbocharged, Water cooled, Four Stroke, Vee Type inline cylinder arrangement, direct injection type, of approved make as per Annexure A generally to following specifications and capable of delivering enough power to serve the peak loads and adequate power margin to recover frequency after abrupt load application. The Engine design shall be such that, it shall give very quick response to maintain frequency within specified limits.

a) Engine cooling system - Pressurised water cooling system with engine driven water circulating pump, Pusher type cooling fan, Set mounted tropical radiator suitable for 50°C Air on temperatures complete with exhaust duct (Flexible connection).

b) Engine Starting system. - 24 Volt D.C. starter Motor.

c)	Engine charging system.	-	24 Volt Battery charging Alternator Heavy duty 24 Volt Lead Acid batteries.
d)	Engine Governing system.	-	Electronic Governor giving Regulation to BS:5514 Class A1.
e)	Engine Lubrication system.	-	Wet Sump with Gear driven pump, lubricating oil filters having replaceable elements and oil heat exchanger.
f)	Engine Fuel System.	-	Fuel Oil Filters with replaceable Elements, Fuel pump, manifold, Injectors etc.
g)	Engine Exhaust System.	-	Residential Silencer with suitable flanges and 10mm asbestos thermal insulation.
h)	Engine Instruments and fault protection.	-	Electrical Engine Temperature Gauge Electrical Oil pressure Gauge, Battery charge Ammeter, Low Oil Pressure High Engine Temperature and Over Speed shutdown with LED indications on control Panel.
i)	Engine Air Filtering System.	-	Heavy Duty Air Filters Dry Type, Replaceable element and with restriction indicator, over all efficiency 99.9% Acc Duct.
j)	Damping.	-	Damping at the engine shall be achieved through suitably designed fly wheel to achieve flicker free operation.
k)	Tools.	-	Routine Maintenance Tool Kit.
l)	Keys.	-	Two Sets of starting keys.

3.2 **Generator**

- Complete Generator with excitation system, brushless type, single bearing type, Class "H" Insulations complying with BS:500 part-99.
- Type of protection - Tropical, Screen protected enclosure.
- Trivialized painted.
- Vibration Dampers.
- Directly coupled through a disc coupling with Engine and mounted on common skid.

3.3 **Enclosure**

The diesel generating set shall be housed in a sound proof enclosure so as to down the noise to acceptable limits 85 dba at 1 meter.

3.4 **Fuel Tanks**

Daily services tank suitable for 6-8 operation hours at full load of generator with level indicators and low level alarm , complete with piping built-in shall be provided.

3.5 **Batteries**

Heavy duty batteries 24 Volt D.C., lead acid type mounted on a frame/tray/stand, battery terminals, complete in all respects.

3.6 **SKID with Earthing Nuts**

3.7 **Literature / Drawings**

Three sets of the following documents shall be handed over to the Project Manager prior to the commissioning and hand over of the gen. sets to the client.

- Installation instructions.
- Operating Manuals.
- Spare parts catalogue.
- Wiring / Foundation Diagram.
- Four wall charts (Operation, Maintenance, Trouble shooting, cautions.

EDGS.4
OPERATING CONDITIONS

All components of the sets are to be suitable for use indoors in tropical conditions and are to be designed to give desired output in an unheated, ventilated building, with the site conditions of humidity and temperature.

The generating set should have following characteristics:

4.1 As the set may be required for either stand-by duty or for base load operation, it should be possible to start, operate and stop the set manually by push buttons, in addition to automatic operation.

4.2 The set's engine shall be equipped with appropriate filters on the air intake(s), capable of operating in a dust-laden atmosphere.

4.3 The set is to be capable of starting and accepting full load within 15 seconds at lowest ambient conditions as stated above. It shall stop automatically in 3-15 minutes (adjustable) after resumption of normal supply.

4.4 The steady state voltage is to be maintained with in ± 1.5% of rated voltage at loads between no load to full load at any P.F between unity and 0.8 lagging , hot to cold . After any change of load the voltage is not to vary by more than ± 2% of the rated voltage and is to return to rated voltage within 3 seconds. The voltage over shoot on starting is not to exceed 5% and is to return to within 3% in not more than 3 seconds.

4.5 The frequency regulation of the set is to be such that when it is taking full load at rated frequency and the load suddenly removed, the frequency is not to rise more than 4% of rated frequency and is to return to its rated frequency within 3 seconds. The resultant steady state frequency is to be maintained ±2%.

4.6 The cycle irregularity of the set at full load is not to be worse than 1/150.

4.7 The deviation of the wave-form of the line voltage output from a pure sine wave is not to exceed the limits specified in BS 2613, but no single harmonic is to exceed 2%

4.8 Radio interference suppression is not to exceed limits specified in BS-800.

EDGS.5
SYSTEM OF OPERATION

The diesel generating plant in the system will be arranged for fully automatic starting upon mains failure. Starting of the system will be initiated by a sensing loop from the main incoming panel. When the main fail, a signal will be given to initiate the start of the generating set.

The automatic start system incorporates a start delay timer set at 5 seconds for generator in the system to ensure that a momentary change in the mains supply will not start the generating plant. The control system also incorporates a run on timer.

5.1 **Engine Protection (Each Generator Set)**

Automatic shut down and lockout will take place in the event of the following faults occurring with the generating plant. Each fault will be of the first up lockout type and is shown by a visual indication on the front fascia of the main control panel together with the sounding of an audible alarm. Each lamp will incorporate a push to test feature. The shutdown faults will be as follows:

Engine fail to start
Engine overload
High engine temperature
Low oil pressure
Engine over speed

5.2 **Lamp Indication**

The following indicators will be supplied on the front fascia of the diesel generating set control panel and will be DC type and fed from the main battery source. All the failure circuits incorporate a press to test facility, which when operated will simulate the fault and shut the generating plant down. Lamp indication will be as follows:-

Fail to start
Overload
High engine temperature
Low oil pressure
Engine over speed
Plant called up
Plant off load
Battery charger off
Engine heaters on

5.3 **Generator Automatic Start Sections 1 and 2**

Engine start control panel will contain the following:

Voltmeter, 96mm. square case, quadrant scale. Ammeter, 96mm. square case, quadrant scale.
Frequency meter, 96mm. square case, quadrant scale.
Kw meter, 96mm. square case, quadrant scale (3 phase unbalanced load type).
Hours counter.
Current transformers as necessary.
Volts/Amps phase selector switch.
Start delay timer set at 5 seconds.
Stop delay timer set at 1 minute.
3 pole output contactor for parallel connection.
Duty selector switch.

Alarm/mute reset switch.
Battery charger with failure warning lamp.
Shutdown circuits as listed under `Engine Protection'.
Lamp indication.
Control fuses in auxiliary circuits.
Engine heater on/off switch.
Manual control equipment.
Three lamp synchroscope.

5.4 **Duty Selector Switch**

A rotary type duty selector switch will be positioned on the front fascia of the generating set main control panel giving full facilities for automatic testing and manual control of the generating plant as follows:-

OFF ..... Automatic starting and control circuit isolated.

NORMAL (AUTOMATIC) ..... Automatic standby to mains supply.

TEST START ..... Test off load.

5.5 **Alarm/Mute Reset Switch**

A rotary type switch will be provided on the front fascia of the main control panel and will give the following functions:-

NORMAL ..... Alarms operational.

MUTE. ..... Alarm horn cancelled.

RESET ..... Reset fault shutdown circuit cancel indicator lamps.

EDGS.6
SPECIFICATIONS

Diesel generating set comprises of AC Generator, flexible coupling, diesel engine, exhaust silencer, batteries heavy duty, radiator (for water cooled engine), fuel tank and engine / alternator control panel. The complete integrated unit is resilently mounted on common steel fabricated base frame.

6.1 **Technical Data**

Ratings:	KVA	KW
Prime Rating as per BOQ.	10% overload for 1 hours within 12 hours	
Power Factor	0.80	
Voltage	415/240 V	
Frequency	50 Hz.	
Speed	1500 RPM	
Site Conditions:		
Relative humidity	90 %	
Ambient temperature.	50°C	

Altitude above sea level	300 meters.

6.2 **Engine Technical Data**

Design.	Turbo charged, direct injection, 2/4 stroke, multi-cylinder, "V" type arrangement
Standards	DIN 6230/BS649 relative humidity.
Output.	
Prime rating as per BOQ.	10 % overload for 1 hour with in 12 hours.
Speed	1500 RPM
Speed Regulation	By means of hydraulic or electronic governor.
Protection	Low oil pressure / high engine temperature.

6.3 **Alternator Technical Data**

Complete Alternator of suitable frame size complying with BS:5000 part 99, revolving field single bearing type, brushless, class "H" Insulation.

Out Put Voltage.	-	3 Phase 380 Volts - 415 Volts. 1 Phase 220 Volts - 240 Volts.
Frequency.	-	50 Hz when running at 1500 RPM.
Power Factor.	-	0.8 - 1.0.
Voltage Regulation.	-	Automatic +/- 0.5%
Frequency Regulation.	-	Automatic +/- 2%
Climatic Conditions.	-	Ambient Temperature 50 C Altitude Rel. Humidity. 60 %
Protection.	-	Automatic short circuit and sustained over load protection should be provided for the generator. It should be tropicalised and screen protected.
Vibration Isolation.	-	Suitable Vibration damping arrangement should be provided.
Mounting.	-	The machine should be directly coupled through a disc coupling with the engine and mountained on a common skid.

6.4 **Fuel Tanks**

A fuel day tanks for 8 hours full load operation of the set shall be supplied with the generator set. The tank shall be suitable mounted on a pedestal at wall brackets or base frame and will be complete with content gauge. The fuel line from day tank to the machine shall be of the internal dia as specified by the manufacturers. In addition to this one 1/2" dia. connection for diesel oil feed line and one 1/2" dia. connection for over flow pipe will be provided in the day tank.

6.5 **Batteries**

A mains operated trickle charge shall be supplied with the D/G set in order to maintain the battery in charged condition. It shall be provided with ON/OFF switch, indicator light, input and output fuses and reverse current protection. Upon operation of the standby plant, the charger shall be disconnected from the battery and from the mains. An ammeter to indicate the rate of charging current and a voltmeter to indicate battery voltage shall be required.

6.6 **Miscellaneous**

R.C.C. inertia block including spring type anti vibration mounting shall be supplied by the contractor. All trenches, duct , covers, railings, gratings, and the like required for the D/G set shall be provided by the contractor. The contractor shall supply and install all piping , cabling and all other accessories for completion of this work to the entire satisfaction of the Project Manager.

6.7 **Automatic Mains Failure Panel**

A floor mounting automatic control panel sheet steel clad, welded construction with access through a locked front door, finished in battleship gray enamel paint and containing the following equipment:-

2- 4pole Motorized circuit breaker suitably rated.
1- Voltmeter, 240 degree scale, scaled 0-500 volt.
1- Voltmeter with seven position selector switch for RN, YN, BN, RY, YB-BR-OFF.
1- M.I.S.C. ammeter 240 degree scale suitably scaled for flushed panel mounting.
1- Ammeter selector switch for R-Y-B-OFF.
1- Frequency Meter, 45-55 Hz, and a 240 degree scale.
1- KWH meter, 3 element type, 3 phase, 4 wire loads.
3- Suitably rated class "C" accuracy, ring type current transformers.
1- Hand voltage Trimmer.
1- Set instrument fuses.
1- Mains voltage monitoring relay suitable for operating on a voltage drop of 15% or more or a complete failure on any one phase.
1- Alternator voltage monitoring relay suitable for operating on a rise in voltage and frequency.

2- Static time delay unit for engine starting and stopping lockout.
1- Pneumatic timer for engine starting and stopping lockout.
1- Triple pole magnetic or voltage controlled, I.D.M.T. overload relay.
3- Percentage differential relays for protection of phase to phase faults in stator winding.
1- Reverse power relay for protection against motoring.
1- Auxiliary relay for controlling circuit breaker trip coil.
1- Over voltage relay with time lag characteristics.
1- Synchronoscope and Synchronizing switch.
1- Set push button for:

START : STOP : RESET

1- Failure to start signal lamp.
1- Load on mains signal lamp.
2- TP&N fully enclosed and interlocked Motrised Circuit Breakers with ON-OFF indicators. One of these contactors would be connected to the normal supply and one would be connected to the cable coming from the emergency supply. There would be a common outgoing.

1- Set of five plug-in type 24 volt DC control relays, each fitted with international octagonal plug-in base and plastic dust proof cover.

1- Set of 230 volts mains operated battery charging equipment suitable for charging a 24 volt battery at a maximum rate of 2 Amps, complete with charging regulator, ammeter mains switch, AC and DC fuses including nickel cadium batteries of suitable capacity.

1- Inter-connections, designation labels etc.
1- Set incoming and outgoing cable glands mounted on a cable tray.

6.8 **Warranty**

The contractor shall provide warranty from the manufacturer against design / manufacturing defects for a minimum period of 12 months from the date of installation / commissioning at site.

6.9 **Maintenance Period**

The Contractor shall be responsible to maintain the Gen-set in perfect running conditions for a period of 12 months starting from the date it has been handed over to the Project Manager of the Client. All expenses for the maintenance and running of the gene-set including operating spares / services but excluding cost of fuel and lubricants shall be considered part of the contract. The contractor shall provide the initial fill of lubricant with the Gensets and only top up lubricants during the maintenance period shall be to the Client's account.

6.10 **Factory Test**

After assembly, the engine shall be mounted on the test bed in the factory and running in carried out for a period of 4 hours. The engine shall then be installed on the base frame together with the alternator and all accessories and satisfactorily tested for a period of atleast 5 hours at the rated speed and load, with one hour test at 10% over-load capacity.

6.11 **Site Performance Test**

Contractor shall perform a 12 hours performance test at full load as per requirements, including 1 hour at + 10% overload. Provision of load shall be to Client's account. A test report shall be prepared and will include the Fuel Efficiency Performance of Gensets/Diesel Engine and a deviation of a mean of 10% from the approved submittal shall be allowed. Client reserve the right to reduce the price of equipment for any additional reduction in performance.

6.12 **Fuel and Lubricants**

All fuel and lubricants expenses required in connections with commissioning testing of the gene-set as per 6.11 above shall be form by the contractor. Commissioning and testing shall be carried out in the presence of nominated authorized Project Manager of the Client.

EDGS.7
INSTALLATION INSTRUCTIONS

Manufacturers recommendations shall be followed strictly.

EDGS.8
MEASUREMENT

For the purpose of measurement each part of the job shall be treated as lump sum job or as specified in the B.O.Q.

SECTION - 9 MAIN L.T. SWITCHBOARD

MPB.1 GENERAL

The L.T. switchboard shall be indoor type, free standing, free supporting , floor mounted, totally enclosed, sheet steel clad, dust and vermin proof, completely wired, factory assembled and suitable for installation back to the wall and capable of front attendance. The switchboard shall comprise of multipanels suitable for housing, air circuit breakers, moulded case breakers or load break switches as shown on the drawings and as listed in the schedule of quantities. The switch board shall be designed to suit services conditions and ensure security and safety during operation, inspection, operation, cleaning and maintenance. The switch board shall be designed and tested to IEC recommendations. Each panel shall withstand strain of 2000 Volts insulation level forone minute power frequency test. The switchboard shall comprise of the following main components and each removable component of the same rating shall be physically and electrically interchangeable. Switchboard to British Electrically Standard 41-5 are also acceptable.

MPB.2 AIR CIRCUIT BREAKERS.

2.1 The air Circuit breaker shall be triple pole of specified rating, front mounted, trip free, spring charged, quick make, quick break manually operated mechanism and visual ON/OFF position indicator. The circuit breaker shall be suitable for continuous period of time under service conditions. The circuit breaker shall have 50/65 KA (or as specified) breaking capacity and shall be capable of the following make / break operations:

Electrical - 500 Cycles.
Mechanical - 8000 Cycles.

The A.C.B. shall conform to BS 4752/1977. The contacts of the A.C.B. shall be heavy duty, spring charged and silver plated. Replaceable arcing contacts and arc chutes shall be provided. The operating handles if made of metal shall be either earthed or additionally insulated to withstand full insulation voltage. A certified copy of full type tests carried out by an independent agency on identical breakers shall be acceptable in lieu of the following type and routine tests :-

i) Making capacity, breaking capacity and short time current tests.
ii) Mechanical and electrical life endurance tests.
iii) Temperature rise test.
iv) Power frequency with stand test.
v) Milli volt drop test.

However all other routine tests shall be witnessed by the Engineer at no additional cost to the Owner.

2.2 The relays shall have three elements, two for the over current and one for the earth fault. These shall be inverse over-current definite minimum time induction type with inverse characteristics. The relays shall be AC operated and provided with time and current setting adjustment of suitable range. The relays shall be equipped with instantaneous elements which have infinity setting or lock out position to make the instantaneous element in operation . The rated error of all the relays shall not be more than 7.5% at full setting. The relay characteristics shall not change plus and minus 7.5% with changes in ambient temperature of ± 10% from the reference temperate of 25 degree centigrade and with changes in the frequency. Certified tests carried out by an independent agency shall be supplied in lieu of the following type tests:-

i) Limit of error test.
ii) Temperature rise test.
iii) Overload test.
iv) Contact rating test.
v) Mechanical durability test.
vi) Variation of characteristics with ambient conditions and frequency.

The relay shall conform to BSS 142/latest.

2.3 Three single pole, resin filled current transformers, 15VA burden, suitable for metering and manufactured and tested to IEC publication 185 shall be provided. The standard accuracy class shall be 0.5% . The rated dynamic peak current rating shall be according to IEC recommendations. The following type tests shall be carried out on C.T.'s:

i)	Short time current test.	-	clause 19
ii)	Temperature rise test	-	clause 20
iii)	Accuracy test	-	clause 29
iv)	Instrument security current test	-	clause 31

The following routine tests shall be carried out on C.T.'s:

i)	Verification of terminal marking.	-	clause 14
ii)	Power frequency test at primary & secondary windings.	-	clause 16
iii)	Over-voltage inter-turn test.	-	clause 17

C.T.’s conforming to B.S. 3938/1973 are also acceptable.

2.4 The following instruments shall be provided unless otherwise specified:-

1 - KWH meter.
1 - Voltmeter 0-500 volts.
1 - Voltmeter phase selector switch.
1 - Ammeter commensurate with rating of ACB.
1 - Ammeter phase selector switch.

All the instruments shall be flush mounted and back connected in a transparent dust proof cover with 144x144mm (6"x6") dial which shall have prominent black graduations on white surface. The instruments shall be manufactured and tested in accordance with IEC publications 51 or B.S.89 part 1/1970.

MPB.3 MOULDED CASE CIRCUIT BREAKERS

The moulded case circuit breakers shall be triple pole and of the rating specified in the schedule of quantities and/or shown on drawings. The MCCB shall be of fixed type, having trip free, solenoid & manually operated mechanism and ON/OFF/Trip position indicators. The MCCBS shall comprise of adjustable hydraulic magnetic releases for overload protection and instantaneous adjustable electro-magnetic releases for short circuit protection. The tripping devices shall have time current characteristics so that positive discrimination and selective tripping is obtained assuring the tripping under fault conditions of only the breaker in the circuit ahead of the fault location. The MCCB shall have a ruputring capacity of 35 KA (or as specified) and shall be manufactured and tested to IEC publication 157-1 Part I or BS 4752/1977 or BSS 3871 Parts I & II. The MCCBS manufactured by Merlin GERIN, Terasaki, ABB, Legerand are acceptable.

MPB.4 **BUS BARS AND CONNECTIONS**

A set of four bus bars, three for phases and one for neutral, made of copper having 98% IASC conductivity shall be provided. The bus bars in panels and chambers shall be tin plated, PVC insulated having minimum clearance of 50mm between phase to phase and 25mm between phase to earth. The neutral bar shall be of the same section. All the bus bars shall be mounted on insulators at suitable intervals and should be extensible on both ends. The marking and arrangement of bus bars, main connections and small wiring shall conform to BS 158/1961. Bus bars and bus bar connections shall conform to BS 159/1957.

MPB.5 **ENCLOSURES**

The enclosures shall be fabricated from 3mm thick high grade sheet steel and shall be designed to house all the live parts which shall be accessible through front doors. The enclosure shall be tropical in design completely dust and vermin proof and liquid repellent, with special regard to danger of flashover both in service and in isolated position. Hinged lockable doors shall be provided on the front and bolted plates at the rear. Adequate air circulation by means of vent covered with suitable metal gauze shall be provided in the enclosures. All exterior and interior surfaces of the enclosure shall be thoroughly cleaned and freed of dust, rust and greasy matter. The enclosures shall be given three coats of paint. The primer shall be Zinc Chromate and/or iron oxide. The second and third coats shall be top quality battleship gray enamel. Enclosure for each panel shall be provided with designation labels as directed by the Engineer. The enclosures / enclsure door shall be double earthed with appropriate size of copper conductor.

MPB.6 **EARTHING**

The switchboard shall be effectively earthed by means of a copper strip of 25mmx3mm (1"x1/8") Cross-section bolted to connections near the bottom of the switchboard.

MPB.7 **ACCESSORIES**

Designation labels, lifting lugs, foundation bolts, interconnecting nuts bolts, and washers, thimbles, lugs, leveling shims cable glands and/or cable end boxes for all the sizes of incoming and outgoing cable shall be supplied with the switchboard.

MPB.8 **TESTING**

The following tests shall be conducted on each complete switchboard:-

a) **TYPE TESTS.**

i) Temperature rise test.
ii) Mechanical endurance test.
iii) Making / breaking capacity test.

b) **ROUTINE TEST**

High Voltage tests.

The switchboard shall be tested to British/Electricity Council standard 41-5 and manufactured by M/s. SA Electric (Pakistan) or M/s Libra or M/s. Electrech. Preference shall however, be given to switchboards fabricated from all components manufactured by only one manufacturer.

MPB.9 **INSTALLATION INSTRUCTIONS.**

All labour, equipment, tools and plant required to complete the installation shall be provided by the Contractor. The switchboard shall be fixed firmly on the floor in perfect line, plumb and level position. All incoming and outgoing cable connections shall be made including earth connections.

MPB.10 **MEASUREMENT**

For the purpose of measurement each L.T. switchboard shall be treated as a lumpsum job.

MPB.11 **SUBMAIN PANEL BOARDS**

The Sub-Main panel board shall be similar to the Main L.T. board and the components in its fabrication may differ and shall comprise of the components as shown on drawings and as described or listed in the Schedule of quantities. The rupturing capacity of the each component for sub-main boards shall be as under:-

1) Air circuit breakers. - 35 KA (or as specified)
2) Moulded case circuit breaker. - 25 KA

All the other details and specification as in section 9 shall be applicable to this section.

MPB.12 **MEASUREMENT.**

For the purpose of measurement each sub main panel board shall be treated as lumpsum job.

SECTION - 10 DISTRIBUTION BOARDS.

DB.1 GENERAL.

The distribution boards shall be either free standing, cubical type or wall mounting type suitable for surface and/or recessed mounting. Each distribution boards (D.B.) shall be tropical in design, fully dust and vermin proof and liquid repellent. The cabinet housing the main components shall be fabricated from mild steel sheets 16 SWG thick and reinforced with structural steel members welded to it. Front access, mechanically locked and hinged doors, fully gasketed, having one or two leafs depending upon the size of the cabinet shall be provided on each cabinet. All openable parts shall be provided with gaskets or lining and screwed to the main body with chromium plated screws. The cabinets after fabrication shall be thoroughly cleaned completely derusted and degreased before applying one coat of zinc or leadbased primer and then two coats of top quality synthetic emulsion or stove enamel paint in battleship gray colour. All exposed parts of the D.B's shall be covered with 5mm thick bakelite sheet. A load distribution chart shall be provided in each D.B showing the areas fed by each circuit and a suitably sized pocket inside the front door shall be provided for the purpose. Each D.B.shall be delivered complete with all instruments accessories, rating plates, designations, as approved by the Engineer.

Suitable cable entry glands shall be provided as required for floor mounted boards on the incoming cables but for outgoing cables and/or wall mounted boards exact number of conduit entry holes as are required shall be provided with male brass bushes. The bushes shall be tin plated and fully shrouded or housed in gasketed compartments.

DB.2 COMPONENTS.

The main components e.g. earth leakage circuit breakers (ELCB / RCCB), moulded case circuit breakers, load break switches, HRC fuses and instrument as shown on the drawings and as described in schedule of quantities shall be the same as described in section 9. However miniature circuit breakers (MCBs) used in D.B's are briefly described hereunder:

DB.3 MCB's.

The incoming shall have triple pole mcb's suitable for use on 415V 50Hz, AC and the outgoing mcbs shall be single pole or single phase for use on 220V, 50Hz, AC. The rating are as shown in drawings and/or described in the schedule of quantities.

The mcbs shall be moulded case type having hydraulic magnetic short circuit releases, contacts , operating mechanism and arcing chambers.

The mcbs shall be manufactured and tested to BSS 3871/1966, and shall have a rupturing capacity of 7.5 KA or as specification B.O.Q. The final circuit mcb's on the outgoing, shall however be rated 5KA. The mcb's manufactured by Merlin GERIN, Legrand , ABB , Terasaki. are acceptable. The distribution boards shall be manufactured by any bonafide manufacturer.

DB.4 INSTALLATION INSTRUCTIONS.

All labour, equipment, tools, plant and accessories required to complete the installation shall be provided by the Contractor . The distribution board shall be fixed as required in perfect line and plumb. All earth terminations shall be made on the neutral block.

DB.5 **TESTING.**

All D.B's shall be tested at manufacturer's works and tests shall be witnessed by the Engineer with out incurring any additional expense to the Owner.

DB.6 **MEASUREMENT.**

Each distribution board for the purpose of measurement shall be treated as a lumpsum job.

SECTION- 11 TELEPHONE STRUCTURED CABLING

TSC. 1 SCOPE OF WORK

The work under this section consists of supplying, installing, testing and commissioning of all material and services for provision of Structured Cabling as specified herein, as shown on Tender Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the Structured Cabling Layout with the Engineer and co-ordinate at site with other services for exact route, location and position of the system.

TSC.2 GENERAL

To ensure optimum performance, components of the structured cabling shall be sourced from the one manufacturer. This shall eliminate potential problems such as electrical and mechanical mismatch between different manufacturers.

Structured Cabling shall be covered under the manufacturers Certified Installation Program and installed by Certified Installation Company. Under this arrangement, the supply of components from the one manufacturer will facilitate the manufacturers Certification requirements of sole supply.

The Structured Cabling shall support the following systems, but not be limited to these systems.

Data Communications

EIA-232-D, RS-422, RS-423, ISDN, Ethernet (10 Base-T, 100 Base-T and 1000 Base-T & 10 Giga), 100 Base VG Any LAN, Token Ring, Fibre Distributed Data Interface (FDDI), Twisted Pair-Physical Medium Dependant (TP-PMD) and ATM (155 Mbs and 622 Mbs), etc.

TSC. 3 APPLICABLE STANDARDS AND CODES

The following standards and all “normative addendums” shall be applicable to this document and must be adhered to for any installation work performed.

EIA/TIA 568-A Commercial Building Telecommunications Cabling Standard.

EIA/TIA 569-A Commercial Building Telecommunications Cabling Standard Pathways and Spaces.

TSB 67 Transmission Performance Specifications for Field-Testing of Unshielded Twisted-Pair Cabling Systems.

IEEE 802.3 Wire Speed Performances

IEEE 802.1Q VLAN

All copper/optical fibre cabling, components and connecting hardware shall be in accordance with latest revision of ISO/IEC 11801, ISO/IEC/TR3 8802-1, ISO/IEC/8802-3, ISO/IEC 61935-1, IEC 60364-1, IEC 60950, EN50173, EN50174-1, EN50174-2, and EIA/TIA TSB 72/73.

TSC. 4 MATERIALS

4.1 Category – 6 Cable (Telephone Network)

The horizontal cabling shall be Category – 6 U/UTP or S/FTP, 4 pair cable with 1.0 Gigabit support and specified up to 250MHz. The cable employed shall have excellent electrical characteristics and shall posses low weight, have slim design and shall be non corrosive (to IEC 60754-2), low smoke (to IEC61034), and flame retardant (to IEC 60332-3) and DIN VDE 0472, Part 804, test type C). The cable shall meet the requirements for EN 55022 Class B emission and EN 55024 immunity to be compliant with standards of electromagnetic compatibility and shall comply with following specifications:

Compliance

IEEE 802.af, IEEE 802.3at for PoE applications
ANSI/TIA-568-C.2:2009 Category 6
ISO/IEC-11801, 2nd Edition Class E
IEC 61156-5:2002 Category 6
LSZH: IEC 60332-1, IEC 60754, IEC 61034

Electrical Specification

- DC Resistance - 72 Ohms / Km
- DC Resistance Unbalance - 2% Max
- Insulation Resistance - 5000M-KM/Min
- Wiring Sequence - TIA/EIA 568 A+B
- Delay Skew - 25 ns/100 meter Max

Mechanical Specification

- Diameter of Copper - AWG 24

- Wire Insulation - PVC/PVC
- Deployment Area - Dry and Damp Rooms
- Temperature Range (moving) - 0 ^{o}C to +50 ^{o}C
- Operating Temperature - -20 ^{o}C to +60 ^{o}C
- Min. Bend Radius for Single Flexure - $\geq$ 40 mm
- Min. Bend Radius during Installation $\geq$ 60 mm

4.2 Category – 6 Outlets (Telephone Network)

The horizontal cabling shall be terminated on Un-shielded or Shielded Cat-6 RJ-45 keystone Jacks support 250 Mhz as per BOQ on white plastic wall plate with shutter. The

category-6 outlets shall have provision of two outlets and shall accommodate one or two inserts (as per BOQ). To maintain security, the module shall not be removable from the front of wall plate. The Cat-6 RJ-45 outlets shall be protected by a spring-loaded shutter which will cover the outlet when not in use. Outlets shall comply with following specifications:

Compliance

IEEE 802.af, IEEE 802.3at for PoE applications.

ANSI/TIA/EIA 568AB.2.2001, ISO/IEC11801:2002

EN50173-2 Category 6 standards

Electrical Specification

- DC Resistance - < 200 milli Ohms
- DC Resistance Imbalance - < 50 milli Ohms
- Insulation Resistance - > 500 Mega Ohms min
- Wiring Sequence - TIA/EIA 568 A+B
- Delay Skew - < 1.25 nanoseconds

Mechanical Specification

Jack Contact

- Material of RJ45 pins - Copper alloy
- Plating of RJ45 pins - Gold plate 1.4 μm
- Operating Life (number of RJ45 Insertions) - 1500
- Plastic Housing (material type) - Polycarbonate (VO)

IDC Block

- Material of metal terminals - Copper alloy
- Wire Accommodation (diameter range) - AWG 22-24
- Tool Accommodation (required or not) - NO
- Gas Tight IDC Cable Termination (yes/no) YES
- Plastic Housing (material type) - Polycarbonate (VO)
- Operating Life (number of re-terminations) up to 5

4.3 Patch Cord: (Telephone Network)

The U/UTP or S/FTP Cat-6 patch cords should be designed for 1.0 Giga applications up to 250 MHz and provides transmission performance meeting Category 6 specifications. Cables should be low skew products. I.e. the difference in propagation delay between the individual pairs is very low. Additional features are the slim design and low weight of the cables. The cable should meet or exceed the requirements for EN 55022 Class B emission and EN 55024 immunity allowing for networks to be built that are compliant with the standards on electromagnetic compatibility.

Compliance

IEEE 802.af and IEEE 802.3at for PoE applications

ANSI/TIA-568-C.2 and ISO/IEC-11801 (2nd Edition), IEC 61156-2,

EN 50173; EN 50288-6-2 Category 6 standard

4.4 Patch Panel: (Telephone Network)

Industry Standard 19" UTP / STP Patch panel capable of accommodating 24 No. Category – 6 U/UTP or S/FTP outlets. The patch panel should be modular having 1U height with integral strain relief. Front panel of patch panel should be made of high-grade steel.

Compliance

EEE 802.3an, IEEE 802.3af (PoE), IEEE 802.3at (PoE+)

ISO/ IEC 11281:2002

IEC 60603-7, TIA-968-A (formerly FCC Part 68 Subpart F)

TSC. 5 INSTALLATION

All cable installations shall be completed according to the local regulatory board and conform to EIA/TIA 568-A and shall comply with the following criteria:

5.1 UTP Cable Installation

Cables shall be installed in already laid steel cable trunking (within suspended ceilings) suitably anchored to the building structure, and in conduit in floor and partitions (concealed). Cables shall be secured every 600mm using hook and loop fastening ties. Due care shall be taken to not over tighten ties and place undue strain on the cabling infrastructure.

Cables shall be bundled to a maximum of 24 UTP cables and each bundle individually supported within the cable trunking.

Bend radius shall be limited to 10 times the cable diameter (UTP).

During the installation of a UTP cable (maximum 90 metres) the pull distance should not exceed 30 metres at any one time.

5.2 Internal Multi-pair Telephone cables should be in accordance with BT type CW 1308. These cables are used for connecting telephone systems and data exchange systems with a plain annealed copper conductor of 0.4mm, 0.5mm, 0.6mm &; 0.9mm diameter with PVC insulation. These are twisted to form a pair and over sheathed in white, cream, gray &; black PVC. A rip cord is laid under the sheath to facilitate its removal. An optional 1.38mm diameter earth copper wire is available on 50 pair cables and above.

Conductor: Class 1 Solid annealed Bare Copper Conductors to

	BS 6360:1991/IEC 60228:2005
	(note - IEC 60228:2005 replaces BS 6360:1991)
Insulation:	PVC (Polyvinyl Chloride)
Twisted Pair:	Two single wires are twisted to form a Pair
Separator:	Polyester Tape longitudinal wrapped
Rip Cord:	Nylon
Earth Wire:	PVC insulated Bare Copper
Outer Jacket:	1) PVC
	2) LSZH (Optional)
Jacket Colour:	Cream

TSC. 6 **TESTING AND COMMISSIONING**

The following tests shall be carried out and the results shall be documented and maintained to from part of the “AS BUILT” drawings.

1. Test all of the UTP copper cable installation for termination and twisted pair integrity, including continuity, polarity, pin-assignment and colour codes

2. Perform visual inspections to ensure that each pair of wires remain twisted as close as possible to the termination point, to maintain the impedance and minimize attenuation losses.

3. Test that the UTP cable pairs comply with the Specification using measuring device for Near End Cross-talk and Signal Attenuation complying with EIA/TIA 568-A.

The documentation required at the completion of the installation phases shall contain all of the following information, together with any other information the installer has acquired during the installation.

1. “As-Built” documentation, showing total cabling and connection installed, utilizing floor space plans and cable record sheets. This documentation shall show all cables and outlets incorporating the full numbering and marking convention supplied.

2. All test results and certification information, identified by cable, connection and numbering convention, necessary for all copper cables.

All components of the Structured Cabling should be sourced from one manufacturer to ensure minimal impedance mismatch and best possible NEXT performance and to guarantee the Category-6 performance from end to end.

The Structured Cabling System should operate without introducing or being affected by electromagnetic radiation from other sources. Maintaining segregation from other services or screening are to be ensured to achieve acceptable immunity.

TSC. 7 MEASUREMENT AND PAYMENT

7.1 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supply, installation, testing, commissioning and completion for all work specified herein and/or as shown on the Tender Drawings related to the item.

7.2 Backbone Cabling

7.2.1 **Measurement**: Measurement shall be made for the total running feet of back bone optical fibre cable acceptably supplied and installed by the Contractor.

7.2.2 **Payment**: Payment shall be made for the total running feet measured as provided above at the Contract unit price each and shall constitute full compensation for supply, installing, testing and commissioning of the backbone optical fibre cable including fibre management system and all accessories.

7.3 RJ 45 - Socket Outlet

7.3.1 **Measurement**: Measurement shall be made for the total number of RJ 45 socket outlet acceptably supplied and installed by the Contractor as a complete unit.

7.3.2 **Payment**: Payment shall be made for number of units measured as provided above at the contract unit price each and shall constitute full compensation for supplying, installing and completion of the RJ 45 socket outlet including all civil works and other accessories.

7.4 Patch Panels

7.4.1 **Measurement**: Measurement shall be made for the total number of each patch panel/cable management/racks acceptably supplied and installed by the Contractor as a complete unit.

7.4.2.1 **Payment**: Payment shall be made for number of unit measured as provided above at the contract unit prices each and shall constitute full compensation for supplying, installing, testing, commissioning and completion of the patch panel/cable management/racks including interconnecting cable trays between racks and all accessories.

7.5 Wiring of RJ 45 Socket Outlets

7.5.1 **Measurement**: Measurement shall be made for the total number of wiring of RJ 45 socket outlet acceptably carried out by the Contractor as a complete unit.

7.5.2 **Payment**: Payment shall be made for the total no. of units measured, as provided above at the Contract unit prices each and shall constitute for supplying, installing connecting, testing, commissioning and completion of the wiring between RJ 45 socket outlet and patch panel and between patch panels including required pair of multi-core data cable, appropriate size conduit and all accessories.

SECTION-12 DATA STRUCTURED CABLING

DSC.1 SCOPE OF WORK

The work under this section consists of supplying, installing, testing and commissioning of all material and services for provision of Structured Cabling as specified herein, as shown on Tender Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the Structured Cabling Layout with the Engineer and co-ordinate at site with other services for exact route, location and position of the system.

The Structured Cabling work with accessories shall also comply with the General Specifications.

DSC. 2 GENERAL

To ensure optimum performance, components of the structured cabling shall be sourced from the one manufacturer. This shall eliminate potential problems such as electrical and mechanical mismatch between different manufacturers.

Structured Cabling shall be covered under the manufacturers Certified Installation Program and installed by Certified Installation Company. Under this arrangement, the supply of components from the one manufacturer will facilitate the manufacturers Certification requirements of sole supply.

The Structured Cabling shall support the following systems, but not be limited to these systems.

Data Processing

Mainframe access, Client Server, Enterprise Server, Messaging Systems and Electronic Mail, common document utilization, Client Database, Voice and Video, etc.

Data Communications

EIA-232-D, RS-422, RS-423, ISDN, Ethernet (10 Base-T, 100 Base-T and 1000 Base-T & 10 Giga), 100 Base VG Any LAN, Token Ring, Fibre Distributed Data Interface (FDDI), Twisted Pair-Physical Medium Dependant (TP-PMD) and ATM (155 Mbs and 622 Mbs), etc.

DSC.3 APPLICABLE STANDARDS AND CODES

The following standards and all “normative addendums” shall be applicable to this document and must be adhered to for any installation work performed.

EIA/TIA 568-A Commercial Building Telecommunications Cabling Standard.

EIA/TIA 569-A Commercial Building Telecommunications Cabling Standard Pathways and Spaces.

TSB 67 Transmission Performance Specifications for Field-Testing of Unshielded Twisted-Pair Cabling Systems.

IEEE 802.3 Wire Speed Performances

IEEE 802.1Q VLAN

All copper/optical fibre cabling, components and connecting hardware shall be in accordance with latest revision of ISO/IEC 11801, ISO/IEC/TR3 8802-1, ISO/IEC/8802-3, ISO/IEC 61935-1, IEC 60364-1, IEC 60950, EN50173, EN50174-1, EN50174-2, and EIA/TIA TSB 72/73.

DSC.4 MATERIALS

4.1 Category – 6a Cable

The horizontal cabling shall be Category – 6a U/UTP or S/FTP, 4 pair cable with 10 Gigabit support and specified up to 500MHz. The cable employed shall have excellent electrical characteristics and shall posses low weight, have slim design and shall be non corrosive (to IEC 60754-2), low smoke (to IEC61034), and flame retardant (to IEC 60332-3) and DIN VDE 0472, Part 804, test type C). The cable shall meet the requirements for EN 55022 Class B emission and EN 55024 immunity to be compliant with standards of electromagnetic compatibility and shall comply with following specifications:

Compliance

IEE 802.3an :2006 (10GBASE-T)
ANSI/TIA-568-C.2:2009 Category 6A
ISO/IEC-11801, 2nd Edition Class EA
IEC 61156-5:2002 Category 6A
LSZH: IEC 60332-1, IEC 60754, IEC 61034

Electrical Specification

- DC Resistance - 72 Ohms / Km
- DC Resistance Unbalance - 2% Max
- Insulation Resistance - 5000M-KM/Min
- Wiring Sequence - TIA/EIA 568 A+B
- Delay Skew - 25 ns/100 meter Max

Mechanical Specification

- Diameter of Copper - AWG 23
- Wire Insulation - Zero Halogen foam - skin Material
- Sheath Material - Zero Halogen, Flame Retardant
- Deployment Area - Dry and Damp Rooms

- Temperature Range (moving) - 0 ºC to +50 ºC
- Operating Temperature - -20 ºC to +60 ºC
- Min. Bend Radius for Single Flexure - ≥ 40 mm
- Min. Bend Radius during Installation ≥ 60 mm

4.2 **Category – 6a Outlets**

The horizontal cabling shall be terminated on Un-shielded or Shielded Cat-6a RJ-45 keystone Jacks as per BOQ on white plastic wall plate. The category-6a outlets shall have provision of two outlets and shall accommodate one or two inserts (as per BOQ). To maintain security, the module shall not be removable from the front of wall plate. The Cat-6a RJ-45 outlets shall be protected by a spring-loaded shutter which will cover the outlet when not in use. Outlets shall comply with following specifications:

Compliance

IEEE P802.3an and TIA/EIA TSB155 (draft) Category 6A specifications

and Class E channel requirements of 2nd edition.

IEC 60603-7-5, ISO/IEC 11801 and CENELEC EN50173-1, the Cat 6A

channel requirements of TIA/EIA-568-B.2-10

Electrical Specification

- DC Resistance - < 200 milli Ohms
- DC Resistance Imbalance - < 50 milli Ohms
- Insulation Resistance - > 500 Mega Ohms min
- Wiring Sequence - TIA/EIA 568 A+B
- Delay Skew - < 1.25 nanoseconds

Mechanical Specification

Jack Contact

- Material of RJ45 pins - Copper alloy
- Plating of RJ45 pins - Gold plate 1.4 μm
- Operating Life (number of RJ45 Insertions) - 1500
- Plastic Housing (material type) - Polycarbonate (VO)

IDC Block

- Material of metal terminals - Copper alloy
- Wire Accommodation (diameter range) - AWG 22-24
- Tool Accommodation (required or not) - NO
- Gas Tight IDC Cable Termination (yes/no) YES
- Plastic Housing (material type) - Polycarbonate (VO)
- Operating Life (number of re-terminations) up to 5

4.3 **Patch Cord (Cat6a):**

The U/UTP or S/FTP Cat-6a patch cords should be designed for 10 Giga applications up to 500 MHz and provides transmission performance meeting Category 6a specifications. Cables should be low skew products. I.e. the difference in propagation delay between the individual pairs is very low. Additional features are the slim design and low weight of the cables. The cable should meet or exceed the requirements for EN 55022 Class B emission and EN 55024 immunity allowing for networks to be built that are compliant with the standards on electromagnetic compatibility.

Compliance

IEEE 802.af and IEEE 802.3at for PoE applications IEEE 802.3an-2006, and ISO 11801 Class EA channel standards IEC 60603-7, ISO/IEC-11801, ANSI/TIA-968-A,ANSI/TIA-568-C.2 Category 6A

4.4 **Patch Panel:**

Industry Standard 19" UTP / STP Patch panel capable of accommodating 24 No. Category – 6a U/UTP or S/FTP outlets. The patch panel should be modular having 1U height with integral strain relief. Front panel of patch panel should be made of high-grade steel.

Compliance

IEEE 802.3an, IEEE 802.3af (PoE), IEEE 802.3at (PoE+), ISO/ IEC 11281:2002 IEC 60603-7, TIA-968-A (formerly FCC Part 68 Subpart F)

4.5 **Fiber Optic Cable (Om3)**

Backbone cabling from the system equipment (Data Centre) to the telecommunication closet shall be connected with optical fiber cable in Star / Ring topology with failover optical fibre link to connecting floors or buildings.

Om3 Fiber optic cabling shall be armored multi-strand 50/125 or Single Mode 9/125 micron support 10 Giga applications as per BOQ for core/cladding diameter multimode / single mode graded index fibers, tightly jacketed. The sheath shall be colored orange or some other bright colour to help distinguish fiber media from other wiring. The cable construction should be metal free to avoid requirement of grounding, lightening protection etc.

Optical Fiber cables Om3 shall be constructed with a central tube filled with water blocking jelly giving it excellent water and moisture resistance. Two corrugated steel armoring and two steel wires strengthening with in the inner PE sheath and an outer PE sheath give this cable excellent tensile strength,

mechanical and environmental protection. They have small diameter, light weight and installation friendly since they come in a single tube with loose tube fibre count up to 12 fibres. Their compact construction protects the loose tube from shrinking, the double armour makes it crush, rodent and impact resistance, the outer PE sheath gives it ultraviolet protection. This cable is suitable for outdoor distribution through ducts, conduits or aerial pipe lines. They come in larger delivery length, so can also be used in long distance communication system, service drop cables, building interconnections.

Specified Core multi-strand 50/125 micron multimode or Single mode, tightly jacketed fiber optic indoor cable. Orange colored outer sheath. Metal free cable construction avoiding requirement of grounding, lightening protection having following physical and transmission characteristics:

Compliance

ITU-T G652.B OS1, ITU-T G652.D OS2, ITU-T G651.1 OM1, OM2, OM3, OM4. IEC60793-2-10 type A1a.1/A1b OM1/OM2 ISO/IEC 11801, ISO/IEC 24702, IEEE 802.3z Gigabit Ethernet ANSI/TIA/EIA 568C.3, RoHS Compliant Directive 2002/95/EC

No. of Fibers:	06, 08,12, 24, 48, 96,
Core Diameter	50.0$\pm$3.0μm or 9.0 micron
Numerical Aperture	0.200$\pm$0.0015
Cladding Diameter	125.0$\pm$2.0μm
Core-Clad Concentricity	$\leq$3.0μm
Cladding Non-Circularity	<2.0%
Core Non-Circularity	$\leq$5%
Coating Diameter	245$\pm$5μm
Coating Cladding Concentricity:	<12
Operating Wavelengths:	850 and 1300 nm
Bare Fiber Attenuation:	2.5 dB/km per 850 nm, 0.8 dB/km per 133 nm
Cable Fiber Attenuation:	3.5 dB/km per 850 nm 1.5 dB/km per 1300 nm

Fiber Type	Type. Attenuation in dB/km		Bandwidth-length product (OFL) in MHz x km	
Multimode Fibre	850 nm	1300 nm	850 nm	1300 nm
(50 um)	2.5	0.8	$\geq$500	$\geq$800

4.6 Fiber Optic Patch Cord (Om3)

Fiber-optic Om3 patch cords support 10 Giga Applications shall be provided for connections with active networking hardware. The cable shall be manufactured from single pair optical fiber. Each patch cord shall be terminated at switch end with SC/MT-RJ/LC connector plugs design to be

pushed on and pulled off active device as applicable to facilitate administration. The patch panel end shall be terminated with duplex SC/LC connectors.

Compliance

TSE: EN 61587-1 Mechanical Structures For Electronic
Equipment - Tests for IEC 60917 and IEC 60297
Climatic and Environment: EN 61587-1/4.2, IEC60068-2-1,
IEC60068-2-2, IEC60068-2-30,
Earth Bond: EN61587-1/6.2
Flammability: EN61587-1/6.3

4.7 Optical Fiber Distribution Frame (OFDF)

Fiber-optic distribution Frame in the Data center & Data cabinet with high-density Om3- SC or LC adaptors for terminating maximum number of cables in least space. The Data center patch panel should be equipped with Om3 SC or LC connectors, which have permanent cabling, connected at the rear and present forward facing SC sockets allowing patching with cords fitted with SC connectors. Provision shall be available for storing extra length of fibers and their dressing.

Optical fiber patch panels on the floors shall be equipped with Om3-SC/LC type connectors, which have permanent cabling, connected at the rear and present forward facing SC sockets, allowing patching with cords fitted with SC connectors at both ends.

Patch panels shall have sliding drawer construction of facilitate easy access to the terminated fibers. Provision shall be available for storing extra length of fibers and their dressing. All fiber-optic cables shall be terminated using fusion-splicing technique via factory-finished pigtails with SC connectors. Patch Panel should have provision to provide secure storage to the fusion spliced pigtails by the use of splice tray/splice cassettes.

4.7-1 Optical Fiber Adaptor / Couplers (Om3)

Om3 Fibre Optic Adaptors are various types including single mode and multimode, Zirconia sleeve and Bronze sleeve, Simplex and Duplex versions. Standard female to female SC Fibre optic adaptor and hybrid SC Fibre optic adaptors are available.

Compliance.

TIA/EIA-568-C.3,TIA/EIA-604 FOCIS-3

4.7- 2 Optical Fiber Pigtails (Om3)

Om3 Fibre pigtails are used in permanent connections between patch panels and incoming cables / single blown fibres. Pigtails are pre-constructed with connectors. Connector options include small form factors such as LC, E2000 and MT-RJ as well as SC, FC and ST. Pigtails shall based on 900µm tight buffered cores (600µm MT-RJ) and suitable for internal use only inside suitable Fibre Management Systems

Compliance.

ISO/IEC 11801
EN50173 -1,ANSI TIA/EIA 568B

4.8 Racks

All racks, shall be modular (Imported) 19 inch racking products. In all cases the backbone cabling sub-system shall be terminated into rack mounted panels and presented as MTRJ fibre connectors. The rack shall have Plexi glass door with pivoted handle and square key. Earthing point, multi socket strip for supplying power to the active components of data network and roof ventilator shall be provided in each rack.

Cable management shall be provided with manageable patching facility. Horizontal management side rings shall provide an environment for ongoing maintenance of all future patching and enable move and changes to be handled easily.

The Contractor shall be responsible for all records and labeling of the rack mounted panels, both fibre and UTP, to the convention provided by the Client.

4.8-1 Wall Mounted Racks.

Wall Mounted Cabinets as per BOQ (Size from 4U to 18U) structure is welded and painted with powder coated. Removable side panels ensure easy installation and maintenance. Easy cab available in different sizes. Comply with ANSI/EIA RS-310-D, DIN41497 part 1, IEC 297-2, DIN41497 part 7, GB/T3047, 2-92 standards.

4.8-2 Floor Standing Racks.

Floor Standing Racks as per BOQ (Size 22U to 47U) shall be modular with vertical cable manager, 4 Way Fans, Front Glass Door, and Rear Perforated with two side opening for easy access. These racks shall accommodate networking accessories and suitable for communication rooms and data centers. Comply with ANSI/EIA RS-310-D, IEC 297-2, DIN 41491, PART 1, DIN 41497, PART 7, GB/T3047.2-92, ETSI standards.

4.09 Metal Cable Management

Metal Cable management facilities within each rack at the Wiring Closet Sub-system are a mandatory requirement.

The cable management channels shall be made up of power coated mild steel 19-inch rack mount panels with integrated “fingers” in which to route the patch leads. The horizontal channel formed by these fingers shall be enclosed by a snap-on ABS metal cover at both ends of panel separate ABS plastic rings shall be mounted using the rack mount bolts of the panel to create a vertical ring run up the rack. These rings shall be sufficiently large enough to comfortably accommodate in excess of 50 patch leads, yet narrow enough not to overhang the width of the rack or obscure the horizontal ring run segment.

The cable management panels should be mounted on the patching facility between active and passive rows of RJ45 ports. In this way, patch leads from every RJ 45 patch panels port are directed to the cable management panels above or below the outlet, so that at no time even when fully populated, outlets are obscured by patch leads. Such a layout shall ensure the patching facility, when cable management is properly utilized, does not go out of control and can be efficiently utilized for adds, moves and changes over the life of the Structured Cabling System.

The metal rings shall be sufficiently large enough to comfortably accommodate in excess of fifty (50) patch leads at any time.

In view of the dynamic nature of the patching facility, the “fingers” of the cable management panels shall be made of mild steel and integral to the metal panel, so that excessive force on the patch leads do not deform the channel formed within the “fingers”. The cable management panel shall be supplied with a snap on cover to discretely conceal the patch leads when the patching facility is static.

To facilitate effective patching during the life of the Structured Cabling System, the rack shall be laid out for minimal clutter and the shortest reasonable route for patch cords.

4.10 Core / Access Switch (HP - 2920 Series Switches)

Access switch should be rack mountable and shall serve the floor users and should have provision to connect to the core switch via fiber optic backbone. Access switch shall have following specifications:

24 x 10/100/1000 ports with 2 Nos. SFP Gigabit ports
2 Nos1000 or 10 G-Base-T–LX–SX-SFP
48 10/100/1000 ports with 2 Nos. SFP Gigabit ports
2 Nos. 1000/10GBase-T-LX-SX SFP

Switching capacity:

24 Port Switch 85 Gbps;
48 Port Switch 148 Gbps

Forwarding rate:

24 Port Switch 6.6 Mpps

48 Port Switch 10.1 Mpps
Store-and-forward switching; latency <12 μs

Layer 2 Switching

MAC Address 8K MAC addresses
VLANs (IEEE 802.1Q)
Link Aggregation IEEE 802.1ad (LACP), Gigabit ports only
Auto-negotiation
Auto-negotiation of port speed, duplex, and connection (MDI/MDIX)
Traffic control IEEE 802.1w full-duplex flow control
Support for Broadcast Storm Suppression (3,000 pps threshold)
STP/RSTP IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)
Backward-compatible with STP
Fast-start mode
Spanning tree enable/disable per port

Layer 3 Switching

Hardware based routing
Multi-netting (multiple IP interfaces per VLAN)
RIP (Routing Information Protocol), v1 and v2
7 Split Horizon
8 MD5 authentication of the RIP packets
9 Password authenticated RIP packets
10 Host route advertisements
Multicast Filtering for 64 multicast groups
IGMP (Internal Group Management Protocol) snooping on Layer 2 interfaces
IGMP 1 and v2
IGMP Querier
Network protocol DHCP (Dynamic Host Configuration Protocol) Helper/Relay
UDP Helper
ARP, ARP Proxy

Convergence

Priority Queues for hardware queues per port
Weighted Round Robin queuing
Traffic Prioritization Priority based on:
7 DSCP (Diff Serv Code Point)
8 IEEE 802.1p Class of Service (CoS) VLAN priority
9 TCP/UDP destination port number
10 Default port priority
11 Auto classification of 3Com NBXR telephony traffic
Bandwidth Management Port-based bandwidth management:
7 1 Mbps increments (10/100 ports)
8 8 Mbps increments (Gigabit ports)

Security

Network Login IEEE 8.2.1X user authentication
Access Control Lists Port-based ACLs

Switch Protocol Security MD5 cipher-text and clear-text authentication for RIP v2 packets
Switch Management Local or RADIUS management of switch passwords
Trusted IP Management Addresses
Telnet

Management

Remote Management SNMP v1
Telnet
Web-based
SNMP
Mirror port/RAP (Roving Analysis Port) One-to-one
RMON (Remote Monitoring) four groups: statistics, history, alarm and events

4.11: Core / Access Switch (HP 1910 / 1920 Series Switches)

Access switch should be rack mountable and shall serve the floor users and should have provision to connect to the core switch via fiber optic backbone. Access switch shall have following specifications:

24 x 10/100/1000 ports with 2 Nos. SFP Gigabit ports
2 Nos1000 or 10 G-Base-T –LX-SX-SFP
48 10/100/1000 ports with 2 Nos. SFP Gigabit ports
2 Nos. 1000/10GBase-T-LX-SX SFP

Switching capacity:

24 Port Switch 45 Gbps;

Forwarding rate:

24 Port Switch 6.6 Mpps

Layer 2 Switching

MAC Address 8K MAC addresses
VLANs (IEEE 802.1Q)
Link Aggregation IEEE 802.1ad (LACP), Gigabit ports only
Auto-negotiation
Auto-negotiation of port speed, duplex, and connection (MDI/MDIX)
Traffic control IEEE 802.1w full-duplex flow control
Support for Broadcast Storm Suppression (3,000 pps threshold)
STP/RSTP IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)
Backward-compatible with STP
Fast-start mode
Spanning tree enable/disable per port

DSC. 5 INSTALLATION

All cable installations shall be completed according to the local regulatory board and

conform to EIA/TIA 568-A and shall comply with the following criteria:

5.1 **UTP Cable Installation**

Cables shall be installed in already laid steel cable trunking (within suspended ceilings) suitably anchored to the building structure, and in conduit in floor and partitions (concealed). Cables shall be secured every 600mm using hook and loop fastening ties. Due care shall be taken to not over tighten ties and place undue strain on the cabling infrastructure.

Cables shall be bundled to a maximum of 24 UTP cables and each bundle individually supported within the cable trunking.

Bend radius shall be limited to 10 times the cable diameter (UTP).

During the installation of a UTP cable (maximum 90 metres) the pull distance should not exceed 30 metres at any one time.

5.2 **Optical Fibre Cable.**

Cables shall be installed in powder coated steel trunking with over including all accessories, supports, etc. as per site requirements, care shall be taken to ensure minimum bending radius requirements as per manufacturer's recommendations for optic fibre cable are maintained.

DSC. 6 TESTING AND COMMISSIONING

The following tests shall be carried out and the results shall be documented and maintained to from part of the "AS BUILT" drawings.

1. Test all of the UTP copper cable installation for termination and twisted pair integrity, including continuity, polarity, pin-assignment and colour codes

2. Perform visual inspections to ensure that each pair of wires remain twisted as close as possible to the termination point, to maintain the impedance and minimize attenuation losses.

3. Test that the UTP cable pairs comply with the Specification using measuring device for Near End Cross-talk and Signal Attenuation complying with EIA/TIA 568-A.

4. Test each termination Optical Fibre in both directions, recording all results of the calibrated optical power. Make sure in all cases that measurements are within those provided in the specification.

The documentation required at the completion of the installation phases shall contain all of the following information, together with any other information the installer has acquired during the installation.

1. "As-Built" documentation, showing total cabling and connection installed, utilizing floor space plans and cable record sheets. This documentation shall show all cables and outlets incorporating the full numbering and marking

convention supplied.

2. All test results and certification information, identified by cable, connection and numbering convention, necessary for all Optical Fibre and copper cables.

All components of the Structured Cabling should be sourced from one manufacturer to ensure minimal impedance mismatch and best possible NEXT performance and to guarantee the Category-6a performance from end to end.

The Structured Cabling System should operate without introducing or being affected by electromagnetic radiation from other sources. Maintaining segregation from other services or screening are to be ensured to achieve acceptable immunity.

DSC. 7 MEASUREMENT AND PAYMENT

7.1 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supply, installation, testing, commissioning and completion for all work specified herein and/or as shown on the Tender Drawings related to the item.

7.2 Backbone Cabling

7.2.1 **Measurement**: Measurement shall be made for the total running feet of backbone optical fibre cable acceptably supplied and installed by the Contractor.

7.3.2 **Payment**: Payment shall be made for the total running feet measured as provided above at the Contract unit price each and shall constitute full compensation for supply, installing, testing and commissioning of the backbone optical fibre cable including fibre management system and all accessories.

7.3 RJ 45 Socket Outlet

7.3.1 **Measurement**: Measurement shall be made for the total number of RJ 45 socket outlet acceptably supplied and installed by the Contractor as a complete unit.

7.3.2 **Payment**: Payment shall be made for number of units measured as provided above at the contract unit price each and shall constitute full compensation for supplying, installing and completion of the RJ - 45 socket outlet including all civil works and other accessories.

7.4 Patch Panels / Cable Management / Racks

7.4.1 **Measurement**: Measurement shall be made for the total number of each patch panel/cable management/racks acceptably supplied and installed by the Contractor as a complete unit.

7.4.2 **Payment**: Payment shall be made for number of unit measured as provided above at the contract unit prices each and shall constitute full compensation for supplying, installing, testing, commissioning and completion of the patch panel/cable management/racks including interconnecting cable trays between racks and all accessories.

7.5 Wiring of RJ 45 Socket Outlets

7.5.1 **Measurement**: Measurement shall be made for the total number of wiring of RJ 45 socket outlet acceptably carried out by the Contractor as a complete unit.

7.5.2 **Payment**: Payment shall be made for the total no. of units measured, as provided above at the Contract unit prices each and shall constitute for supplying, installing connecting, testing, commissioning and completion of the wiring between RJ 45 socket outlet and patch panel and between patch panels including required pair of multi-core data cable, appropriate size conduit and all accessories.

7.6 Switches

7.6.1 **Measurement:** Measurement shall be made for the total number of each type of switch, acceptably supplied and installed by the contractor as a Complete Unit.

7.6.2 **Payment:** Payment shall be made for the number of unit measured as provided above at the contract unit price each and shall constitute full compensation for supplying, installing, testing and commissioning of the Member / Master Switch including connectivity with the fiber optical panel and Master Switch and all accessories.

SECTION - 13 FIRE ALARM SYSTEM

FAS. 1 Scope

Furnish a complete 24V DC analogue addressable, electrically supervised, zone annunciated, fire detection and alarm system as specified herein and indicated on the drawings. The system shall include but not be limited to, a control panel or panels with integral power supply to provide the 24V DC, signal initiating devices, audible and visual alarm devices, and all accessories required to provide a complete and operating system.

The fire alarm system shall be wired as 2 core signal loops. 24V DC power wiring shall be installed to alarm sounders via addressable sounder modules or via conventional monitored sounder outputs within the control panel.
Loop powered sounders shall be connected directly to the signal loops..

FAS. 2 Codes and Standards

The following codes and standards shall apply to work of this section.

EN54-2 and EN54-4	-	Fire Alarm CIE and PSE
ISO9001	-	Quality control
BS 5839:part 1	-	Fire Detection and Alarm Systems for Buildings

FAS. 3 Qualifications of Manufacturers

Manufacturers of the products supplied for the fire alarm system shall have been in the business of manufacturing Fire Alarm products for at least five years. They shall confirm compliance to the above codes and standards.

FAS. 4 Fire Alarm Control Panel (FACP)

4.1 Functional Description

The fire alarm control panel (FACP) shall be the central processing unit of the system, receiving and analyzing signals from fire sensors, providing audible and visual information to the user, initiating automatic alarm response sequences and providing the means by which the user interacts with the system.

The FACP shall be certified as meeting the requirements of EN54-2 and EN54-4 by a suitable, notified body. A certificate and test report shall be made available for inspection as evidence of certification.

The FACP shall be easily configurable to meet the exact detection zone and output mapping requirements of the building.

The FACP shall be microprocessor based and operate under a multitasking software program. Operating programs and configuration data shall be

contained in re-configurable non-volatile memory. Retention of the memory shall not rely on any form of battery or capacitor back-up device. The FACP shall incorporate separate processors for loop processing and central processing.

Provision shall be made for each addressable loop to be sub- divided into geographical zones. The section of wiring corresponding to each zone circuit shall be protected from faults in other sections by line isolator modules.

In order to facilitate re-configuration and system extension, the allocation of addresses to devices shall be independent of their physical arrangement on the loops.

Up to 240 individually addressed standard devices shall be configured on each addressable loop. Loop powered sounders and beacons incorporated as sensor bases shall be available.

The FACP shall have the capability to support sub-addressing of addressable modules.

It shall be possible to fit a 40-column printer to the FACP which will print system events automatically and logged data upon request.

The FACP shall incorporate a real time clock to enable events to be referenced against time and date.

4.2 Additional Components

It shall be possible to fit the FACP with a network board to allow up to sixty-four control panels to communicate with each other. The network shall be fully fault tolerant and shall continue to function normally under any single fault condition.

It shall be possible to fit the FACP with a modem board to allow remote interrogation and monitoring of a network of control panels.

It shall be possible to fit up to thirty-two, sixteen way input/output modules, eight way relay modules, six way sounder modules or four way conventional zone modules or any combination thereof to each control panel. Modules shall connect to a separate serial bus but shall be programmable in the same manner as devices connected to the addressable loops.

4.3 Configuration

It shall be possible to perform configuration updates on site using a portable personal computer and a Windows ® based configuration utility. This facility shall allow the following parameters to be set: -

4.4 System

a) Produce a configuration file which contains data for up to 64 control

panels connected together as a network.

b) Set cause and effect tables for any device to operate devices or functions on any panel or panels connected to the network.

c) Upload and view graphically the configuration from a single panel or entire network of panels.

4.5 Control panel

a) Panel name (network identity, fifteen characters minimum)
b) Panel text (comfort message or service company forty characters minimum)
c) Change code numbers for access levels two and three.
d) Select sounder ringing mode as common, zonal or two stage
e) Select first and second stage delay times for each sounder output to between zero and five minutes.
f) Set number of loops on panel as one, two or four
g) Set number of zones on panel as 0,16, 48 or 96
h) Set loop sounder volume globally
i) Set start and end times for day night mode for each day of the week

4.6 Detectors

a) Allocate a zone
b) Set a delay before the panel responds to a fire signal
c) Indicate pre-alarm
d) Set day sensitivity and night sensitivity separately
e) Address loop powered base sounders
f) Allocate a forty character location text message

4.7 Call points

a) Allocate a zone
b) Allocate a forty character location text message

4.8 Switch units (input)

a) Allocate a zone for each input and the device itself
b) Define input action as fire, fault, pre-alarm, technical alarm, evacuate, alert, security alarm, silence alarm, reset, transparent, disablement or test mode.
c) Change the input action message from the default to any one of the above or to any one of a user defined library of 10 additional action messages.
d) Set a delay before the panel responds to a fire signal
e) Select whether the input requires the control panel to be reset or is self clearing upon removal of the input
f) Allocate a forty character location text message

4.9 Relay or sounder units (output)

a) Allocate a zone for each input and the device itself

b) Define whether the device responds to evacuate inputs, as a sounder (default ringing), is silenceable, needs to be reset or produces a single pulsed operation of between one and five seconds (programmable)
c) Has a delay before operating (zero to five minutes)
d) Allocate a forty character location text message

4.10 Loop powered sounders and beacons

a) Allocate a zone
b) Define whether the device responds to evacuate inputs, as a sounder (default ringing), is silenceable or needs to be reset.
c) Has a delay before operating (zero to five minutes)
d) Allocate a forty character location text message

4.11 Panel Construction

The housing containing the FACP shall be of metal construction and shall be capable of being surface or semi-flush mounted. It shall be complete with cable knocks-outs in sufficient quantity to accommodate all likely cabling requirements.

The housing shall afford a minimum ingress protection to IP30 and it shall not be possible to open the FACP without the use of a special tool or key.

4.12 Panel Indications

The FACP shall monitor the status of all devices on the addressable loops for fire, short-circuit fault, open-circuit fault, incorrect addressing, unauthorized device removal or exchange, pre-alarm condition and contaminated detector condition.

The FACP shall also monitor the status of internal connections and interfaces including charger and batteries.

The FACP shall provide the following discrete visual indications:

a)	POWER ON	green LED indicator
b)	FIRE ALARM	red LED indicator
c)	PRE-ALARM	yellow LED indicator
d)	ON TEST	yellow LED indicator
e)	BUZZER SILENCED	yellow LED indicator
f)	DELAY ACTIVE	yellow LED indicator
g)	MORE EVENTS	yellow LED indicator
h)	GENERAL DISABLEMENT	yellow LED indicator
i)	GENERAL FAULT	yellow LED indicator
j)	POWER FAULT	yellow LED indicator
k)	SYSTEM FAULT	yellow LED indicator
l)	SOUNDER FAULT/DISABLED	yellow LED indicator

4.13 Display

In addition to the indications above, the FACP shall have an integral 240 x 64-pixel graphic LCD display.

The display shall incorporate a backlight which will illuminate upon any event (excluding mains failure) or button press.

The display shall be capable of simultaneously indicating the number of outstanding events and their types as well as the current event.

4.14 Panel Controls

The panel shall be provided with at least the following manual controls: -

a) SILENCE BUZZER
b) ACKNOWLEDGE ALARM
c) RE-SOUND ALARM
d) RESET
e) LAMP TEST
f) FUNCTION 1
g) MORE FIRES
h) MORE EVENTS
i) HELP
j) MENU NAVIGATION PAD (UP,DOWN,LEFT,RIGHT,ENTER,EXIT)

4.15 Remote Monitoring Signals

The FACP shall contain at least three programmable inputs to allow interconnection to other systems.

The FACP shall contain at least two programmable outputs to allow interconnection to other systems.

The FACP shall be capable of monitoring and controlling remote site devices, such as relays for the control of plant and dampers directly from the addressable loops.

The FACP shall be capable of monitoring fire doors such that, in the event of a fire alarm condition, an event is generated to warn of the failure of a fire door to close.

4.16 Software

The FACP shall have, as a standard software enhancement, the ability to annunciate a pre-alarm condition designed to give the earliest possible warning of potential fire condition without raising the full alarm condition.

The FACP shall have as a standard software enhancement the ability to automatically adjust the alarm threshold levels to compensate for changes in detector sensitivity due to contamination over a period of time.

The FACP shall have, as a standard software enhancement, the ability to

provide an indication that a detector is nearing a level of contamination, which requires that it be replaced or serviced.

The FACP shall have, as a standard software enhancement, the ability to provide automatic warning that a detector has reached a level of contamination, which requires that it be replaced or serviced.

The FACP shall have, as a standard software enhancement, the ability to synchronize loop data transmission to eliminate the possibility of data corruption due to cross-talk or similar effects.

The FACP shall have, as a standard software enhancement, extensive, context sensitive help screens to offer additional information on system status at all times.

FAS. 5 Sounders

The FACP shall provide the necessary outputs to separately operate a minimum of two monitored circuits of common system sounders. Each output shall be capable of driving a sounder load of up to 1A.

The FACP shall also be able to monitor the integrity of and control standard sounder circuits, via a suitable addressable module.

The FACP shall be capable of providing a two-stage alarm sounder facility that can be programmed, either on a zonal basis or common system basis, to meet the requirements of the fire authority. Sounder outputs shall be available as follows:

- Alert, intermittent pulsed tone
- Evacuate, continuous tone

The FACP shall have the facility to change, on a per sounder zone basis, the sound output dependent upon whether the source of alarm is:

- an automatic detector, e.g. smoke, heat,
- a manual call point.

The FACP shall have the facility to generate a slow pulsed output to all sounder circuits in response to a security alert input.

FAS. 6 Fault Reporting

The FACP shall monitor all critical system components and interconnections, internal and external, such that a failure, which would prevent the correct operation of the alarm functions, causes the FAULT indicator to light and a message to be given on the alphanumeric display within 60 seconds of occurrence.

The following faults shall be reported in the manner described above: -

a. Loop Short Circuit

b. Loop Open Circuit
c. Un-configured Device
d. Device missing
e. Addressable Device Failure
f. Incorrectly Configured Device
g. System fault (processor)
h. Low battery
i. Charger failure
j. Earth fault monitoring
k. Battery Fault
l. Mains Failure
m. Sounder Wiring Open Circuit (per circuit)
n. Sounder Wiring Short Circuit (per circuit)

To help fault finding and repair, the FACP shall provide text messages to indicate the location of where a fault has occurred in the system.

FAS. 7 System Management

The FACP shall incorporate the following system management facilities:

a. Isolate/re-connect individual outputs or inputs of addressable points
b. Isolate/re-connect individual zones
c. Isolate/re-connect individual loops
d. Isolate/re-connect all or individual sounder circuits
e. Isolate/re-connect all volt-free contacts individually
f. Isolate/re-connect panel inputs
g. Walk-test of a selected zone to verify detectors and sounders
h. View system status
i. Print event log
j. Print point status.
k. Set time
l. View contamination status

Access to the facilities describe above shall be restricted to user Engineer level or above.
The FACP shall have an event log capable of storing the last 500 events that have occurred. It shall be possible to view the content of the log via the alphanumeric display. Events shall be displayed in chronological order with the newest events first. It shall be possible to scroll through the events.

The FACP shall be designed so that, for each type of analogue addressable detector, the overall response time including the sensor, the signal transmission system and the fire decision algorithm, meets the requirement of European Standards.

The FACP shall be capable of isolating a group of selected detectors in areas of the building where maintenance work is carried out.

FAS. 8 Automatic Fire Detectors (General)

8.1 General

The manufacturer shall have available the following types of analogue

addressable automatic sensors, for direct connection to the system addressable loops:

- Ionisation smoke sensors
- Photoelectric smoke sensors
- Heat sensors
- Multi-sensors

8.2 Addressable Units

The manufacturer shall be capable of offering two-state addressable versions of the following units, taking only one address from the loop:

- Ionisation smoke detectors
- Photoelectric smoke detectors
- Heat detectors
- Photoelectric beam smoke detectors
- Ultra-violet flame detectors
- Conventional detector interface module
- Addressable sounder modules
- Addressable relay interface modules
- Addressable switch monitoring modules
- Short circuit isolator modules (no address required)
- Loop powered sounders
- Manual call points for indoor use
- Manual call points for outdoor use
- Multiple inputs/outputs
- Radio interfaces to detectors and call points

8.3 Conventional Units

The manufacturer shall have available the following types of conventional automatic detectors, manual call points and ancillary units for connection to the system via suitable interfaces:

- Ionisation smoke detectors
- Photoelectric smoke detectors
- Photoelectric beam smoke detectors
- Ultra-violet flame detectors
- Heat detectors
- Manual call points for indoor use
- Manual call points for outdoor use
- Remote indicator units
- Sounders

Analogue Addressable and addressable detectors and modules must be able to transmit to the FACP an address to be used in the system configuration.

It must be possible to connect and mix automatic detectors, addressable manual call points and addressable modules within the same zone sub-division of an addressable loop.

All equipment connected to the system addressable loop, either directly or via interfaces, shall be proofed against electrical noise, high frequency pulses and electromagnetic influences from other equipment.

The manufacturer shall have available suitable equipment to test and remove or exchange all three main types of automatic point-type detectors when installed.

8.4 Ionization Smoke Detectors

The Ionization smoke detectors shall be capable of detecting visible and invisible combustion gases emanating from fires, using a dual Ionization chamber in which the air is ionized by a single radioactive source.

The radioactive source used shall be AM 241 of one microcurie or less.

The Ionization smoke detectors shall be designed to have high resistance to contamination and corrosion and shall include RFI screening to minimize the effect of radiated and conducted electrical interference.

The Ionization smoke detectors shall be suitable for operation in air speeds of up to 10m/s and shall incorporate screens to minimize the effects of small insects.

The manufacturer shall have available the following versions of the Ionization smoke detector to meet different applications:

- Analogue addressable
- Conventional

The Ionization smoke detector shall incorporate LED's, clearly visible from the outside, to provide indication of alarm actuation.

In locations where the detector is not readily visible, remote indicator units shall be provided.

8.5 Photoelectric Smoke Detectors

The photoelectric smoke detectors shall be capable of detecting visible combustion gases emanating from fires and shall employ the forward light-scatter principle.

The point-type photoelectric smoke detectors shall be equally sensitive to a wide range of combustible materials.

The design of the point-type photoelectric smoke detector sensing chamber shall be optimized to minimize the effect of dust deposit over a period of time. The chamber cover shall be removable for ease of cleaning or replacement.

The point-type photoelectric smoke detectors shall incorporate screens

designed to prevent all but the very smallest of insects from entering the sensing chamber, (50 holes per square centimeter or more).

The photoelectric smoke detectors shall be designed to have high resistance to contamination and corrosion and shall include RFI screening to minimize the effect of radiated and conducted electrical interference.

The manufacturer shall have available the following versions of the point type photoelectric smoke detector to meet different applications:

- Analogue addressable
- Conventional - normal sensitivity
- Conventional – normal sensitivity – delayed response
- Conventional – normal sensitivity – Intrinsically Safe

The photoelectric smoke detector shall incorporate two LED's, clearly visible from the outside, to provide indication of alarm actuation.

In locations where the detector is not readily visible, remote indicator units shall be provided.

8.6 Multi-Sensors – Analogue Addressable

The multi-sensor should be capable of monitoring two different sensing elements:

1) Photoelectric
2) Thermal

The design of the point-type multi-sensor photoelectric smoke detector sensing chamber shall be optimized to minimize the effect of dust deposit over a period of time. The chamber cover shall be removable for ease of cleaning or replacement.

The point-type multi- sensors shall incorporate screens designed to prevent all but the very smallest of insects from entering the sensing chamber, (50 holes per square centimeter or more).

The multi-sensors shall be designed to have high resistance to contamination and corrosion and shall include RFI screening to minimize the effect of radiated and conducted electrical interference.

The sensor should be able to operate in the following modes:

8.7 Combination Mode

The sensor should be able to operate as a photoelectric sensor but when the ambient temperature reaches 40^{o} C or above, the thermal elements should be capable of sensing the 'Rate of Rise' and adjust the sensitivity of the photoelectric element automatically. The sensitivity of the photoelectric should be increased via an internal algorithm.

8.8 Photoelectric mode

The sensor should be able to return the analogue value for the photoelectric element during a normal polling sequence.

The sensor should also be able to signal to the FACP if the thermal sensing element exceeds a fixed temperature threshold.

8.9 Thermal mode

The sensor should be able to return the analogue value for the thermal element during a normal polling sequence. The sensor should also be able to signal to the FACP if the photoelectric sensing element exceeds a pre-defined threshold.

The multi-sensor shall incorporate LED's, clearly visible from the outside, to provide indication of alarm actuation. The LED's should be controlled from the FACP if the LED's flash during the normal polling sequence.

The modes of the multi-sensor should be controlled by the FACP, when the FACP changes from one mode to another the FACP should re-calibrate the multi-sensor.

In locations where the detector is not readily visible, remote indicator units shall be provided.

The multi-sensor should have the capability of monitoring both sensing elements, if either or both of the elements fail it should be reported and displayed at the FACP.

8.10 Duct smoke detectors

The manufacturer shall produce standard equipment for the installation of smoke detectors in air ducts. This equipment shall be designed to accommodate the manufacturer's standard smoke detectors and bases: Analogue addressable, Addressable and conventional.

8.11 Heat detectors

The heat detectors shall be capable of detecting rapid rise in temperature and/or fixed absolute temperatures.

The heat detectors shall employ two heat-sensing elements with different thermal characteristics to provide a rate of rise dependent response.

The heat detectors shall include RFI screening to minimize the effect of radiated and conducted electrical interference.

The manufacturer shall have available the following versions of heat detectors to meet different applications:

- Analogue addressable – grade 1, 2 or 3.
- Two state addressable – grade 1
- Two state addressable – grade 2
- Conventional – grade 1
- Conventional – grade 2
- Conventional – range 1
- Conventional – static 60 C
- Conventional – static 90 C

The heat detectors shall incorporate LED's, clearly visible from the outside, to provide an indication of alarm actuation.

In locations where the detector is not readily visible, remote indicator units shall be provided.

8.12 Detector Base

The automatic point-type fire detectors shall be fixed to the installation by mean of plug-in bases. Analogue addressable bases, sounder bases and conventional detector bases shall be available.

The three types of bases specified above shall incorporate the optional feature of being able to lock the detectors in place once plugged in. Termination facilities shall be available for earthing.

Standard conventional and Analogue Addressable bases shall not contain any electronic circuitry. This shall enable insulation and continuity checks to be completed on the wiring with the detector heads removed.

FAS 9 Other devices

9.1 Addressable Manual Call points

The addressable manual call points shall monitor and signal to the FACP the status of a switch operated by a "break glass" assembly. They shall be red in colour and suitable for surface or flush mounting. The addressable call points shall be provided with an integral red LED to indicate activation.

One version of the addressable call point shall be available mounted in a weatherproof housing, affording protection to IP 66.

The addressable call points shall be capable of operating by means of thumb pressure and not require a hammer. They shall be capable of being tested using a special 'key' without the need for shattering the glass.

The addressable call points shall incorporate a mechanism to interrupt the normal addressable loop scan to provide an alarm response within 3 seconds and shall be field programmable to trigger either an alert or an evacuate response from the FACP.

9.2 Addressable Sounder Module

The addressable sounder module shall be capable of monitoring and controlling two independent circuits of alarm sounders using a single loop address.

24 V DC power to drive the sounders shall be derived independently from the FACP.

The addressable sounder module shall be capable of operating both sets of

sounders in a pulsing or continuous mode as determined on the module. Each circuit shall be individually programmable. Sounder circuits shall be capable of synchronization.

The addressable sounder module shall provide the facility to monitor the wiring to the sounders for open or short-circuit and transmit the necessary fault signal to the FACP. Each sounder circuit shall be separately fused.

The addressable sounder module shall provide the facility to monitor for failure of the power supply for the sounders and transmit the necessary fault signal to FACP.

The addressable sounder module shall provide a green LED indication when the FACP is polling it.

9.3 Conventional detector interface module

The conventional detector interface module shall be capable of monitoring two independent zones, each of up to 30 conventional detectors using a single loop address.

24 V DC power to power the conventional detectors shall be derived independently from the FACP.

The conventional detector interface module shall provide the facility to monitor the detector zones for open or short-circuit and transmit the necessary fault signal to the FACP.

The conventional detector interface module shall provide a remote LED facility to indicate detectors in alarm and shall provide a red LED indication when the FACP is polling it.

9.4 Addressable relay interface module

The addressable relay interface module shall be capable of switching two independent relays; either normally open or normally closed, each rated at 30V, 1Amp.

A single input shall provide open and short circuit monitoring facilities, set locally at the unit.

The addressable relay interface module shall use a single loop address.

The unit shall be powered directly from the addressable loop.

The addressable relay interface module shall provide an LED indication when the FACP is polling it.

9.5 Addressable switch monitoring module

The addressable switch monitoring module shall be capable of monitoring two independent voltage free contacts, each either normally open or normally closed, using a single loop address.
The unit shall be powered directly from the addressable loop.

The addressable switch-monitoring module shall provide a red LED indication when the FACP is polling it. The LED shall be continuously lit when either input is active.

9.6 Short Circuit Isolator Module

The short circuit isolator module shall provide protection on the addressable loop by automatically disconnecting the section of wiring between two modules where a short circuit has occurred.

The short circuit isolator module shall derive power directly from the addressable loop and shall provide an LED indication that the module has tripped. A base mounted version is available.

9.7 Loop powered sounders

Addressable electronic sounders shall be connected directly to the detection loops where required. These shall be incorporated in a suitable mounting base so that an analogue smoke or heat sensor may also be connected to the base, if required. Loop powered sounders shall be ceiling or wall mountable. A cover plate shall be fitted when a sensor is not to be fitted on the sounder.

9.8 Photoelectric beam smoke detectors

The photoelectric beam smoke detectors shall be capable of detecting visible combustion gases emanating from fires and shall utilize the light obscuration principle. The emitter shall project a near infra red beam to the receiver.

Two types are acceptable:

1. The photoelectric beam smoke detectors shall consist of an emitter and a receiver pair. The detectors shall operate over a 5 – 100 metre range.
2. A Photoelectric reflective beam smoke detector consisting of a combined control unit and a separate reflector. The detector shall operate over a 5-30 metre range.

   The photoelectric beam smoke detectors shall have automatic

recalibration in order to adjust for contamination.

The photoelectric beam smoke detectors shall be designed to have high resistance to corrosion and shall include RFI screening to minimize the effect of radiated and conducted electrical interference.

The photoelectric beam smoke detectors shall incorporate two LED's, clearly visible from the outside and below, to provide indication of alarm actuation and fault.

9.9 Ultra-violet flame detectors

The flame detector shall be of a point-type. It shall be mounted on its base using a simple twist action for ease of installation and removal.

The flame detector shall be able to detect weak ultra-violet rays in a 120 cone of vision, in a direct line of sight.

9.10 Remote Indicator Unit

The remote indicator unit shall provide a remote indication for any detector that may be located in an enclosed or locked compartment.

The remote indicator unit shall be driven directly from its associated local detector. It shall be either flush or surface mountable.

FAS. 10 Sounders

Two types of Electronic sounders shall be acceptable: loop-powered addressable sounders (see above) and stand-alone versions. Stand-alone versions shall powered by 24 Volts DC from the FACP.

Non loop-powered versions shall be flush or surface mountable, red in colour. They shall have a minimum sound output of 95 dB (A) at 1 meter distance and shall have a maximum current consumption at 24V DC of 100 mA.

FAS. 11 Alarm Bells

Fire alarm bells shall be under dome type with a high resonance pressed alloy-steel gong to ensure a load clear-tone ring. They shall be fully suppressed and polarized.

The operating mechanism shall be fully enclosed and the gong shall be red stove enameled for long life.

Alarm bells shall have a minimum sound output of 95 dB (A) at 1 metre distance, and shall have a maximum current consumption at 24V DC of 30 mA.

SECTION - 14 CABLE TRAY SYSTEM.

MTS.1 GENERAL.

The metal tray system shall generally be routed under the ceiling slabs and only above the false ceiling and / or passages not normally open to public access. The contractor shall supply all labour, material and accessories for the completion of this installation strictly in accordance with the specifications laid as under, illustrated on drawings and shown in the Schedule / Bill of Quantities.

MTS.2 DESIGN.

The cable tray system shall be designed on the standardized modular system and comprise of basic modules of trays, fittings and accessories. Each modular shall be fabricated from sheet steel and then hot dip galvanized of 60 microns . Modular of 90 degree Elbows, T joints and double T joints shall be used for horizontal changes in the direction of cable runs while hinged connectors shall be used for vertical branch offs. The branch-off joints should be such as to allow for angle connections to be easily bolted to them (joints) by means of button-head screws. End plates shall be used to close off unevenly cut faces of the cable trays and protect the cables from damage. Where required barriers shall be used to permit power cables and cables of all modules shall be subject to the prior approval of the Engineer before mass production is taken in hand . The cable tray shall have standard lengths of 3000 mm.

The following standard sizes shall be used:

	Width	***Height***	***Approx.Wt.Each.***
Cable Trays	150mm	35mm	1.41 Kg.p.meter.
	300mm	35mm	2.25 Kg.p.meter.
	450mm	60mm	4.00 Kg.p.meter.
Barriers.	-	35mm	0.44 Kg.p.meter.
	-	60mm	0.64 Kg.p.meter.
Elbows.	150mm	35mm	0.43 Kg.p.meter.
	300mm	35mm	1.12 Kg.p.meter.
	450mm	60mm	2.31 Kg.p.meter.
T-Joints.	150mm	35mm	0.51 Kg.p.meter.
	300mm	35mm	1.45 Kg.p.meter.
	450mm	60mm	2.83 Kg.p.meter.
Double	150mm	35mm	0.75 Kg.p.meter.
T-Joints.	300mm	35mm	1.53 Kg.p.meter.
	450mm	60mm	2.87 Kg.p.meter.
Hinged	-	35mm	0.11 Kg.p.meter.
Connectors.	-	60mm	0.24 Kg.p.meter.
Connectors.	-	35mm	0.11 Kg.p.meter.
	-	60mm	0.18 Kg.p.meter.
Angle	-	35mm	0.07 Kg.p.meter.
Connectors.	-	60mm	0.11 Kg.p.meter.

	Width	***Height***	***Approx.Wt.Each.***
Wall Bracket.	150mm	-	0.31 Kg.p.meter.
	300mm	-	0.50 Kg.p.meter.
	450mm	-	0.89 Kg.p.meter.

Pandant	150mm	-	0.20 Kg.p.meter.
Brackets for	300mm	-	0.41 Kg.p.meter.
Pendants	450mm	-	0.69 Kg.p.meter.
Pandant	300mm	-	0.70 Kg.p.meter.
with Head Plates.	450mm	-	0.91 Kg.p.meter.
End plates.	150mm	-	0.06 Kg.p.meter.
	300mm	-	0.14 Kg.p.meter.
	450mm	-	0.21 Kg.p.meter.

MTS.3 **INSTALLATION INSTRUCTIONS.**

The cables tray shall be installed on ceiling / wall as required in perfect line and plumb. The clearance between fixing points shall be 1 meter. The cable tray shall be solidly earthed with 1"x1/8" copper tapes on both sides. All cables shall be clipped with PVC strap to the tray at every interval of 1 meter.

MTS.4 **MEASUREMENT.**

For the purpose of measurement the cable tray shall be treated as actual running length installed in meters inclusive of all elbows, tees, suspensions etc. and fixing accessories or as specified in B.O.Q.

SECTION - 15 SUBSTATION EQUIPMENT

SSE.1 HIGH TENSION SWITCHGEAR.

1.1 The switchgear shall be 11000 volt metal clad type of 350 MVA breaking capacity for indoor application. It shall be triple pole and all the three poles shall be coupled so as to operate simultaneously.

1.2 The switchgear shall comprise of vacuum circuit breaker/load break switches as specified in the B.O.Q.

1.3 The switchgear shall be supplied and tested in accordance with the following International Electro Technical Commission Publications:-

IEC Publication 56-1
IEC Publication 56-1A
IEC Publication 56-1B
IEC Publication 56-2
IEC Publication 56-3
IEC Publication 56-4
IEC Publication 185 - Specifications for Instruments.

1.4 The definitions given in the above IEC Publication shall apply herein.

1.5 In case the requirements laid down herein differ from those given in the IEC Publications, these requirements shall be deemed to be in addition of the requirements as laid down in IEC Publication.

1.6 All the associated equipment and accessories shall be constructed and designed so as to comply with all the requirements set out in these specifications.

1.7 The switchgear shall be designed for indoor use and to be mounted on the floor.

1.8 The switchgear shall be supplied in the form of single panels for quick assembly at site in the form of a switchboard.

1.9 Each panel shall comprise of drawout type circuit breaker and all its associates equipment and accessories shall be self contained and self supporting. Each panel shall be capable of being connected to a switchboard on either side.

1.10 In each panel the circuit breaker shall be equipped with a mechanism for moving it physically between the connected and dis-connected positions and also equipped with self-aligning and self coupling primary and secondary dis-connecting devices.

1.11 All secondary circuit wiring, instruments, meters and relays etc., shall as faras possible be isolated by grounded metal barriers from all primary circuit elements with the exception of short lengths of wires such as instrument transformer terminals.

1.12 All removable components of the same type and rating in a switchboard shall be physically and electrically interchangeable.

1.13 The breaker shall have mechanical "ON", "OFF" and "EARTHED" position indicator.

1.14 Mild steel rail's shall be provided at the base to guide smooth entry of the breaker carriage into the panel.

1.15 The terminals and inter-connections between parts shall be designed to ensure permanently low resistance contacts. The power carrying circuits shall be capable of carrying its rated current at rated voltage and rated frequency continuously with out excessive maintenance. Even after repeated fault interruption, the capability of the circuit breaker to carry its rated current continuously shall notbe seriously impaired. The manufacturer's literature and technical data to prove this point shall be furnished by the Contractor.

1.16 The circuit breaker shall be capable of interrupting any current from zero to its rated breaking current when used on any predominanently resistive and / or inductive circuits. The breaking time at all ratings less than the rated breaking current shall not exceed the rated breaking time.

1.17 The arc interrupting mechanism shall be designed with ample mechanical and electrical factors of safety in all its parts. The parts shall consist of a minimum number of assemblies arranged for convenient installation and readily removable for repair or inspection.

1.18 The mechanical strength and physical characteristics of the insulation structure shall be such that it can withstand the shocks of the circuit breaker operations within the rated capacities and reasonable strains of connecting conductors under the specified service conditions. This insulation shall be in accordance with the classification of IEC publication No.85.

1.19 Circuit breakers shall be so constructed that the interval between the contacts of the individual poles touch or separate shall not exceed 10 ms during closing or opening operation.

1.20 The rods or tubes used for raising or lowering the moving contacts of the circuit breaker shall be securely pinned at each end to prevent rotation or displacement of the contacts.

1.21 Ventilation outlets from circuit breaker shall be so arranged that any discharge of oil / or gases or both will not cause electrical breakdown and shall be directed away from a likely place where an operator may have to be in the course of his ordinary duties. The construction shall be such that gas cannot collect at any point where fire can becaused during or after operation, by sparks arising from normal working of the circuit breaker or its ancilliary equipment.

1.22 A set of 6 male and 6 female silver plated selfaligning isolating contact shall be provided for separating the breaker from the busbars. These shall be interlocked facility. The shutters shall be marked "BUSBARS" and "CABLES" and distinctly coloured. No operation shall cause exposure of the high voltage bus or equipment. The shutters shall operate with certainty upon the withdrawal and replacement of a removable portion but shall be so arranged as to permit the cover over a set or sets of live contacts to be locked by hand in the closed position while the cover over the dead contacts may be opened.

1.23 Silver plated plug contacts shall be provided between separate units to complete the secondary circuits. they shall be pressed loaded self aligning type.

The temperature rise of the main circuit of a circuit breaker shall not exceed the values given in Table I of IEC publication 56-2. The maximum temperature of auxiliary circuits and devices when the circuit breaker is carrying the rated current and voltages and when tested in accordance with Clause II of IEC publication N.56-2 shall not exceed the values given in Table -I . The reference ambient temperature shall be taken as 50 degree centrigrade.

These circuit breakers shall have the following characteristics:

S.NO.	*Characteristics.*
1. Current Rating	630 Amps.
2. Voltage Rating	11/12 KV
3. Frequency	50 Cycles/Sec.
4. Breaking Capacity	350 MVA.
5. Breaking Current Sym	18.4 KA/16.9KA
Asym	23 KA/21 KA
6. Making Capacity	892.5 MVA
7. Power Frequency withstand voltage.	
i) Type Test	36 KV
ii) Routine Test	28 KV
8. Impulse withstand voltage	95 KV
9. Operating duty	0-15 Cycles-Co -Cmn-Co.
10. Total maximum break time.	6 Cycles.

1.24 The circuit breakers shall be capable of breaking any power upto their rated breaking capacity. For all recovery voltages between the two rated voltages the breaking capacity ratings in Amperes shall be inversely proportional to the voltage. For recovery voltages below rated voltages the breaking capacity expressed in amperes shall have a constant value corresponding to the lower rated voltage.

1.25 The operating mechanism shall be charged spring power mechanism with manual push button for closing and opening the breaker. The closing spring shall be hand charged.

1.26 The mechanism shall be trip free.

1.27 The closing mechanism shall not prevent or delay the opening of the circuit breaker beyond the standard interrupting time.

1.28 Latches shall be so designed as to not require delicate of frequent time.

1.29 The mechanism shall be such as to give a minimum of 1000 operations without wear, breaking or adjustments. Each operation shall consist of complete opening and closing of the circuit breaker.

1.30 The mechanism shall be of robust construction and of rust proof materials. It shall be capable of withstanding shocks and prevent inadvertent operation due to fault current stresses, vibrations or other causes. Convenient means of applying lubricants where needed shall be provided.

1.31 The mechanism shall be provided with means to prevent operation during maintenance.

1.32 The following routine tests shall be made on all circuit breakers and manufacturer's certificate shall accompany each breaker.

i) Temperature rise test (IEC publication 56-2 Clause 15)
ii) Test for operating conditions (IEC publication 56-4 Clause -17)
iii) Power frequency dry voltage (IEC publication 56-4 Clause 19)
iv) Tests on auxiliary circuits (IEC publication 56-4 Clause 19)
v) Oil Tank leakage tests by any one of following methods:

a) Compressed Air test.
b) Oil or Water pressure test.
c) Penetrating liquid without pressure.

1.33 The contractor shall make suitable arrangements for the Engineer to witness such test at the manufacturers premises or any recognized test laboratory without any expense to the Owner, entirely at the contractor's cost.

1.34 Duly certified and complete test reports of tests carried out by an independent authority on one representative breaker of the same design shall be submitted by the contractor failing which he shall arrange to carry out the following type tests to be witnessed by the Engineer without any expense to the Owner.

i) Temperature rise test (IEC publication 56-2 Clause-10)

ii) Making capacity and breaking capacity rating and short time current rating test (IEC publication 56-1 Part-III).

iii) Operation tests and mechanical endurance tests (IEC publication 56-3 Clause 36 except that number of closing and opening operations in case of mechanical endurance that shall be 1000)

iv) Impulse voltage dry withstand test (IEC publication 56-4 Part-4)

v) One minute power frequency voltage dry withstand test (IEC publication 56-4)

vi) One minute power frequency voltage wet withstand test (IEC publication 56-4 Part-4)

1.35 A set of three busbars made of 98% I.A.S.C. electrical conductivity copper of current rating of 1000 Amps shall be provided.

1.36 The busbars shall be fully covered with insulation capable of withstanding the full of line voltage. These shall be supported on porcelain insulators and air insulated. The busbars shall be tinned at all joints and a drawing showing details and methods of jointing shall accompany the breakers.

1.37 Bracing of sufficient mechanical strength shall be provided to withstand forces of short circuit current to the extent of 23 KA.

1.38 The busbars shall be capable of extension on either side and have adequate provision for expansion and contraction due to temperature variations over a range of 80 degree centigrade.

1.39 Single pole, epoxy resin insulated, dry type self-contained indoor current transformers suitable for mounting in switchgear shall be supplied.

1.40 The current transformers shall be manufactured and particulars listed therein.

1.41 The transformation ratio shall be as stated in the Bill of Quantities.

1.42 The current transformers shall have two core construction and each core shall be designed for protection and metering. Both cores shall be identical.

1.43 The minimum output on any tap for each core of current transformer shall be 30 VA for protection and 10 VA for instruments and metering. The standard accuracy class for the protective service shall be 10P and the accuracy limit factor shall be + 1%. The standard accuracy class for the instrument and metering service shall be + 1% . The rated short time thermal current rating shall be 13.1 KA. The rated dynamic peak current which the current transfomers will withstand without being damaged electrically or mechanically shall be 33.4 KA.

1.44 The insulation levels for the current transformers shall be as under:

Highest Expected Voltage	One Minute power Frequency with stand voltage(rms)	Impulse with stand voltage KV Peak.
12 KV	**34 KV**	**95 KV**

1.45 The following routine shall be made in accordance with IEC publication 185 for all ratios and at all taps:

i) Verification of terminal markings (Clause 14)

ii) Power frequency test at primary windings (Clause 15)

iii) Power frequency test at secondary windings (Clause 16)

iv) Over voltage interturn test (Clause 17 and Clause 40 as applicable).

1.46 The following type test shall be carried out in accordance with IEC publication 185:

i) Short time current test (Clause 19)
ii) Temperature rise test (Clause 20)
iii) Impulse voltage test (Clause 21)
iv) Accuracy test (Clause 29)
v) Composite error test (Clause 39)
vi) Tests for instrument security current (Clause 31).

The above tests may be omitted if a complete type test result for an identical transformer carried out by an independent agency is applied by the manufacturers.

1.47 Three phase, self-contained, indoor, drawout type voltage transformers shall be supplied as required and detailed in the Bill of Quantities. The transformers shall be epoxy resin insulated.

1.48 The rated frequency shall be 50 Hz and voltage ratio shall be 11000/110 Volts. The accuracy and tests shall have the above noted frequency and voltage ratio as reference.

1.49 The characteristics shall be as follows:

i) Rated Burden VA 100 per phase.
ii) Accuracy Limit 0.6 %

1.50 The voltage transformer shall withstand for one second the mechanical and thermal stresses resulting from a short circuit on the secondary terminals with full voltage maintained on the primary terminals.

1.51 The following tests shall be carried out on the voltage transformer:-

i) Dielectric test of low frequency.
ii) Impulse test on high voltage windings only.
iii) Ratio and phase angle tests at one standard burden.
iv) Temperature rise tests.
v) Impedance Test.

The dielectric test voltage shall be as under:

Rated Primary	Low Frequency Test Voltage. (rms)	Impulse Test Voltage		
		Chopped wave	Min.Time Flash-over Voltage	Full wave Crest Voltage.

1.52 The voltage transformers shall be equipped with fuse and fuse links in accordance with B.S. 88/1967.

1.53 Back connected dust proof, semi-flush, switchboards type protective relays with transparent removable and sealable covers shall be provided. These shall be preferably plug-in withdrawable type and all operations for removal and replacement shall be carried out from the front side of the panel.

1.54 The relays shall be suitable for climatic conditions described in these specifications and capable of 5000 electrical operations when tested at rated quantities and at a rate which will not result in overheating. The relays shall withstand a test-voltage of 2000 volts (rms).

1.55 The relays shall be three element type two for over current and one for earth fault. These shall be inverse over-current definite minimum time induction type with inverse time characteristics . These shall be either directional or non-directional as suited to the service conditions.

1.56 All relays shall be A.C. operated and provided with time and current setting adjustments with suitable range.

1.57 The relays shall be equipped with instanteous elements with a setting range from 10 to 40 amps. adjustable continuously. It shall also have an infinity setting or lock out position to make the instantaneous element in-operative.

1.58 The rated error of all protective relays shall be not more than 7.5% at all settings. The relay characteristics shall not change more than plus or minus 7.5% with changes in ambient temperature of plus or minus 10 degree centigrade and with changes in frequency of plus 2% and minus 6% from the rated frequency.

1.59 The following type of tests shall be carried out:

i) Limits of error.
ii) Temperature rise test.
iii) Overload test.
iv) Contact rating test.
v) Mechanical Durability.
vi) Variation characteristics with ambient conditions and frequency.

Certified test results by an independent agency on the type of relays shall be supplied by the manufacturer.

1.60 All live parts of the panel including busbars, connections, circuit breaker, isolators, voltage transformer, current transformers shall be suitably enclosed. Access for normal maintenance shall be through doors with locking facilities. The enclosure shall have hinged door in front and bolted plates in rear. However, the incoming panels will be provided with hinged doors with locks in the rear as well.

1.61 The enclosure shall be made of high grade sheet steel of minimum thickness 1/8" (3mm) except that smaller compartments may be of a lesser thickness. The steel sections shall be rigidly welded and the entire enclosure shall be self-supporting and free standing. Suitable eye bolts shall be provided for lifting each individual panel by means of slings. The enclosure shall be completely vermin proof with special regard to dangers of flashover both in service and isolated positions.

1.62 The enclosure and the breaker shall be completely derusted and degreased. It shall be given a priming coat of either zinc chromate or iron oxide or any other equivalent.

1.63 The following instruments shall be installed on the incoming panels:

i) One voltmeter 0-12 KV range, moving iron spring controlled in a pressed steel case.

ii) One ammeter of suitable range conforming to the C.T. ratio, moving iron, spring controlled in pressed steel case.

iii) One voltmeter phase selector switch.

iv) One ammeter phase selector switch.

v) One KWH meter with M.D.I.

vi) One KVArH meter.

1.64 The indicating instruments shall be flush mounted back connected, dust proof with a transparent dust proof cover. The normal size of the instruments shall be 6"x6" or 144mm x 144mm. The sails shall be white with permanent, black graduations.

1.65 The instruments shall be manufactured and tested in accordance with IEC publication 51.

1.66 C.T. operated KWH and KVArh meters shall also be installed where required. The meters shall be manufactured and tested in accordance with I.E.C. publication 43.

1.67 The panel or the switch board as described in the Bill of Quantities shall be delivered complete at site ready wired complete with name plate, designation labels, circuit labeling the small wiring shall be tested at 2000 volts D.C.

1.68 The following data shall appear on the name plate of each break:

1. Manufacturers Name and Address.
2. Manufacturer's type, designation and serial number.
3. Year of Manufacture.
4. Owner's Identification Mark.
5. Standard to which Manufactured.
6. Rated voltage.
7. Rate Frequency.
8. Rated Normal Current.
9. Rate Impulse withstand voltage.
10. Symmetrical breaking capacity.
11. Assynetrical breaking capacity.
12. Rated short time current.
13. Making Capacity.
14. Rated operating duty.
15. Total break time at rated breaking current.
16. Control and tripping voltage.

1.69 The switchgear as detailed in the Bill of Quantities shall be delivered tested and commissioning at site under this contract and shall be complete in every respect, and manufactured by M/s. Siemens (Pakistan) or M/s. PEL (Pakistan) or approved equivalent.

SSE.2 **INSTALLATION OF THE SWITCHGEAR.**

The Electrical contractor shall provide all labour , equipment and tools necessary for complete installation as well as all ahimming of the supporting steel frame that may be required to set the switchgear in level position. The equipment shall be fixed firmly on the floor according to the manufacturer's recommendations. All outgoing and incoming cable connections so that no danger of damage during operation is possible. All terminal block connection shall be checked for any loosens.

SSE.3 **MEASUREMENT.**

This job shall be treated as lumpsum job for measurement purposes.

SSE.4 **PAYMENT.**

Payment shall be made for each complete switch board as described in the Bill of Quantities.

SECTION - 16 POWER FACTOR IMPROVEMENT PLANT.

PFIP.1 **GENERAL**

The power factor improvement plant Auto cum Manual shall be indoor type, free standing , floor mounting, sheet steel clad, totally enclosed, completely dust proof, fabricated from 3mm thick mild steel sheet suitably ventilated with vermin proof louvers, supplied fully assembled, readily wired, as one integral unit and capable of alignment to Main L.T. Switchboard . The use of mechanical forced ventilation is allowed. The plant shall be designed to house all delicate components e.g. p.f. meter, sensing relay, Main and auxiliary contactors, Auto/Manual Switch, ON/OFF push buttons, indicator lights, control fuses with bases etc. in dust proof enclosures.

The fabricated plant housing shall be completely cleaned, degreased and derusted, before applying one coat of antirust primer and two coats of battleship gray enamel.

The plant shall be designed to meet the service condition at site and provide reasonable assurance of performance in mechanical and electrical adjustments. The plant shall be suitable for use on 415V, 50Hz, 3 Phase 4 wire, A.C. supply.

PFIP.2 **COMPONENTS.**

2.1 Each capacitor shall have rating of not more than 12.50/25/50 KVAR and shall conform to B.S. 1650/1971. Full capacitance of the plant as specified shall be capable of being switched in 10 equal steps. The capacitors shall be rated 525 V. The capacitor bank shall consist of single phase capacitors arranged in star formation with solidly grounded neutral.

2.2 A 12 stage sensing relay with time delay characteristics shall be provided for carrying out all switching operations automatically.

2.3 A manual control switch shall be provided to carry out manual switching if and when required.

2.4 Magnetic contactors suitable for 380/420 volts operation shall be provided in sufficient numbers to carry out automatic switching operations. The contractor shall conform to B.S. 775/latest.

2.5 Suitable discharge resistors and hoods shall be provided.

2.6 A 6" x 6" dia. flush mounted power factor meter shall be supplied.

2.7 The PFI plant shall be any approved manufacturer.

PFIP.3 **TESTING**

3.1 The capacitors shall be charged by application of full voltage for a period of one minute and then discharged through resistors. This will constitute one cycle and the tests shall be carried out for 5 such cycles.

3.2 The sensing relay shall be tested in accordance with tests specified in B.S. 142.

3.3 All small wiring shall be subjected to a high voltage test at 2000 volts for one minute.

3.4 The plant as a whole shall be tested by the application of inductive load.

3.5 Six copies of complete specification of each components alongwith six copies for test certificates shall be furnished by the contractor.

3.6 The owner may require his Engineer to witness all or any test at manufacturers works and the Contractor shall cause such tests to be performed without any extra cost to the Owner.

PFIP.4 **INSTALLATION INSTRUCTIONS**

Installation instructions of Main L.T. Switchboard are applicable to this section as well.

PFIP.5 **MEASUREMENT**

This job shall be treated as a lumpsum job for the purpose of measurement.

PFIP.6 **PAYMENT**

Payment shall be made for each complete PFI plant as specified in the Bill of Quantities.

SECTION - 17 POWER TRANSFORMERS.

PT.1 **GENERAL**

Three phase Power Transformers for indoor use having transformation ratio of 11000/415 Volts at frequency of 50Hz and KVA ratings as given in the Bill of Quantities shall be supplied and erected by the Contractor.

1.1 The transformers shall be manufactured, supplied and tested in accordance with the following standards:

i) British Standard 171/1959 - Power Transformers.

ii) British Standard 358/1959 - Measurement of voltage with sphere gaps.

iii) British Standed 923/1940 - Impulse voltage testing.

iv) British Standard 2757/1964 - Classification of insulating materials for electrical machinery and apparatus on the basis of terminal stability in service.

v) American Standards Association C.57.12.1956 - Requirements terminology and test code for distribution power and regulating transformers and reactors other than current limiting reactors.

vi) I.E.C. Publication 76 - Recommendations for power Transformers.

vii) I.E.C. Document 14 (Secretariat) 53.

viii) I.E.C. Document 14 (Secretariat) 54.

ix) I.E.C. Document 14 (Secretariat) 55.

x) I.E.C Publication 60 - High Voltage test techniques.

1.2 The transformers shall be oil immersed type with core and windings immersed in natural mineral oil. The core shall be of a laminated construction made of high grade electric steel sheet rigidly packed and free of vibrations due to frequency and stresses.

1.3 The windings shall be uniformly insulated. the thermal class of insulating material shall be Class-A. Test voltage shall be based on highest of the system voltage i.e. 12 KV. Power frequency voltage shall be 28 KV and impulse voltage to be 95 KV. The wave being 1/50 micro-seconds.

1.4 The insulation to earth of the winding shall be uniform.

1.5 The limits of temperature rise above ambient of the windings, cores and oil shall be as under:

Winding	-	50 °C
Core	-	50 °C
Oil	-	45 °C

1.6 The transformer shall be designed and constructed to withstand, without damage, the effects of short circuit of magnitude equal to 25 times the symmetrical r.m.s value of valid current for 2 seconds.

1.7 The transformer shall be capable of withstanding, without damage on any tapping, under service conditions, the electromagnetic forces arising under short circuit conditions as determined from the symmetrical peak value of the current in the winding which shall be taken as not greater than 2.55 times the over current derived.

1.8 The transformer shall be capable of withstanding without damage to any tapping under service conditions the thermal effects of a short-circuit at the terminals of any winding for 2 seconds.

1.9 The transformer shall be provided with regulating taps. The adjusting tapping shall be + 2-1/2%, normal, - 2-1/2%, - 5% and - 7-1/2%. The tapping being located on the higher voltage winding.

1.10 Tap changing shall be affected by means of an externally operated off circuit switch capable of being locked in position. It shall be accessible with safety.

1.11 When tapping are used to compensate for variation of voltage the transformer shall be capable of operation at its rated KVA capacity on any tapping without injury. The tap changing gear shall be capable of carrying the same currents, due to external short circuits.

1.12 The method of cooling shall be natural air, the method of circulation of oil shall be by natural thermal head and would be indicated by symbol ON.

1.13 The primary windings shall be "delta" connected and the secondary winding shall be "Star" connected internally. The star point shall be brought out as neutral. The internal connections shall be clearly indicated on the nameplate together with tap changing connections. The vector group DY 11 of the transformer shall also be indicated on the nameplate.

1.14 The transformer tank shall be of welded construction made of high grade steel plate. It shall have either a finned external construction or tubular construction to facilitate the natural air cooling.

1.15 The tank shall be tested for any leaks by any of the following methods:-

a. Compressed Air test.
b. Oil water pressure Test.
c. Penetrating liquid without pressure.

1.16 An oil conservator tank fitted with a dehydrating breather and oil level indicator shall be internally fitted to the transformer tank.

1.17 The complete assembled tank shall be tested to withstand without deformation or leakage a pressure of 15 lbs/sq. in (1.05 Kg/sq.cm).

1.18 The tank finish shall be battleship colour. The paint shall be highly resistant to the effects of high temperatures and shall have a long life under the normal working conditions. As a minimum it shall consist of a priming coat and two finish coats applied after complete derusting and degreasing of the tank. The thickness of the paint shall not be less than 0.12 mm.

1.19 The oil level indicator shall be visual glass type with minimum oil level marking at 30°C and with two additional marks "Empty" and "Full" to be provided. These corresponding to the upper and lower temperatures for which the transformer is required to operate on site.

1.20 Compound filled cable and boxes for 3 core P.I.L.C. or XLPE cable on H.T. side and 3-1.2" core PVC/PVC/SWA/PVC cable on L.T. side or as per B.O.Q. shall be provided for connecting the transformer to relevant switchgear. Arrangement for solidly grounding the neutral shall be made.

1.21 The following routine tests shall be carried out on the transformers in the presence of the Engineer.

i) Temperature Rise Test.
ii) Impedance Test.
iii) Ratio and phase angle test at one standard load.
iv) Dielectric Test of low frequency.

1.22 A certified copy of a complete type tests carried out on an identical transformer shall accompany each transformer failing which the contractor shall make arrangements to carry out these tests in the presence of Engineer without any extra expense to the Owner.

1.23 The following fittings shall be provided with each transformer.

i) Rating Plate.
ii) Terminal marking plate.
iii) Lifting Lugs.
iv) Earthing Terminals for Tank.
v) Oil filling hole and plug.
vi) Oil level indicator.
vii) Drain valve with built-in sampling device.
viii) Conservator.
ix) Air vent.
x) Dehydating Breather.
xi) Dial type thermometer with maximum temperature indicator.
xii) Double Float Buchhlz Relay complete with auxiliary relay on the panel.
xiii) Steel Rollers with rolling direction parallel to the longer side.

1.24 The rating plate shall carry the following information:

i) Manufacturers Name.
ii) Manufacturers Serial Number.
iii) Year of Manufacture.
iv) Owner's Identification Mark.
v) Rated KVA.
vi) No. of Phases.
vii) Frequency.
viii) Rated voltage at no load (Higher Voltage/Lower Voltage).
ix) Percent Impedance Voltage.
x) Rated current (Higher Voltage / Lower voltage).
xi) Winding connections and phase displacement symbols of vector diagram.
xii) Type of cooling.
xiii) Total weight of the transformer.
xiv) Total quantities and weight of the oil.
xv) Weight of core and winding assembly.

1.25 The terminal marking plate shall carry the following information:-

i) Vector Group Symbol.
ii) Winding connections of high voltage and low voltage sides.
iii) Tapping with subscripts.
iv) Voltage ratios at various tappings the lower voltage being kept constant.
v) Rated current (Higher Voltage/Lower Voltage).

Letters ABC shall be used for the high voltage side and a b c shall be used for low voltage side.

1.26 The transformers shall be manufactured by M/s. SIEMENS (Pakistan) or by M/s. J&P or by M/s. PEL or by Climax.

The transformers of the ratings as given in the Bill of Quantities shall be supplied tested erected and commissioned under this contract and shall be complete in every respect with first filling of dehydrated mineral oil specified hereinafter.

PT.2 MEASUREMENT

This job shall be treated as lumpsum job for measurement purposes.

PT.3 PAYMENT.

Payment shall be made for each transformer unit as specified in the Bill of Quantities.

PT.4 OIL FOR TRANSFORMERS

4.1 Oil for transformers shall conform to British Standard 148.

4.2 Insulating Oil shall be straight run mineral oil obtained from fractional distillation of crude petroleum, refined specially for use as an insulating and cooling medium in oil immersed transformers.

It shall be free from water, sediments, foreign materials, and petroleum fractions which may be injurious to equipment or any of its components, such as insulation, paint, varnish and metallic or other parts. It shall be free of synthetic additives of all types.

4.3 An inhibitor ditertiary butyl paracresd, which increases substantially the resistance to oxidation at high temperatures encountered in service shall be added and the requirements of BS/148 shall be modified when inhibitor is used.

4.4 For satisfactory service of the equipment the oil dielectric strength above 40 KV will not be required when tested according to BS 148.

PT.5 MEASUREMENT.

No measurement is involved for this item as each equipment using this oil is reckoned complete with oil.

PT.6 PAYMENT.

Payment of oil is included with the equipment using the oil.

SECTION - 18 EARTHING

E.1 GENERAL.

The contractor shall be under obligation to supply all material and labour for the completion of the Earthing system as shown on drawings, listed in the schedule / Bill of Quantities and conforming to specifications laid down, hereinafter. The completed installation shall, in general, conform to British Code of Practice CP 1013/1965 and regulations of Pakistan Electricity Act. In the case of any conflict, specifications laid down hereinafter shall be followed.

E.2 CIRCUIT PROTECTIVE CONDUCTOR.

The Circuit Protective Conductors and earthing leads shall be solid hard drawn, insulated electrolytic copper wires of sizes given on the drawings and Bill of Quantities. All fixing accessories such as saddles, copper bolts, nuts, and washers shall be provided. The size of conductor above 19/.083 shall be of 1-1/8" flat copper strip or as specified.

E.3 EARTH POINT.

It shall comprised of 1" dia & 10 ft long steel rod with 1mm copper conductor sleeve of 99.97% imported copper as earth electrode 100ft below ground level including cost of boring and lowering the rod 100ft down, complete with clamp and appropriate size of stranded copper conductor from rod to ground surface in 1½" dia G.I. pipe (length 20' only) with tee on top having watering cap, earth access hole comprising of 8" dia, 12" deep 16-SWG M.S. cylinder with 12-SWG M.S. cover, both hot dipped galvanized, as per detail shown in drawings.

E.4 EARTH CONNECTING POINT.

The earth connecting point in switch room or sub-station shall comprise 300mmx50mmx5mm (1'x2"x1/4") electrolytic copper bar having as many terminals of 3/8" dia. copper bolts, nuts, and washers as are required. The earth bar shall be fixed on bus bar insulators of appropriate size. The fixing bolts shall be galvanized and provided for fixing the bar on the wall. The bar shall be tinned for protection against corrosion. Copper tapes from various equipment and earth point shall be terminated on this bar.

E.5 EARTH ELECTRODE.

For the earthing of poles or any devices or equipment rates less than 15 KW, earth assembly as shown on the drawing shall be installed.

E.6 MANHOLE.

Cast concrete inspection manhole covers shall be provided on each earth point, as shown on drawings.

E.7 INSTALLATION INSTRUCTIONS.

7.1 The circuit protective conductor (CPC) shall be run, inside, all along the conduit installation. The CPC shall be insulated as specified elsewhere.

7.2 The C.P.C. or copper strip shall be laid all along the length of perforated metal tray or walls of masonry ducts, fixed at 3' intervals. At terminations the CPC or traps shall be bolted firmly to the equipment as per standard practice. Copper tape at straight through joints shall be brazed or cad welded. Joints between standard CPC shall be avoided or cad welded.

7.3 Earth plate shall be buried upright 1' below the natural sub-soil water level but not less than 20 ft. below the ground level. A mixture of salt and char-coal shall be laid

and packed upto 12" all around the plate . 1/2" dia. G.I. pipe with a TEE at the top shall be provided for watering arrangement during dry season and/or where no sub soil water is available.

E.8 **MEASUREMENT.**

8.1 Each point and earth manhole shall be treated as lumpsum job for the purpose of measurement.

8.2 CPC or tape, for the same purpose shall be measured as actual length installed.

8.3 For CPC in conduit wiring no separate measurement shall be taken and it shall be deemed to have been included in the rates of point wiring as in section W.

SECTION - 19 LIGHTNING PROTECTION SYSTEM

LPS.1 GENERAL.

The Contractor shall be under obligation to supply all labour and material for the completion of this installation to specification laid hereinafter, as shown on drawings and listed in the Bill of Quantities. The installation shall in general conform to British Standard BSEN 62305-1:2006.

LPS.2 SPECIFICATION.

2.1 The Lightning Protection System shall comprise of lightning capturing by air terminals and roof conductors and conveying it to mass of earth via down conductors and earth electrodes.

2.2 The air terminal shall be cast and machined in electrolytic copper, conforming to BSS 1400, and shall be complete with single pointer rod as shown on the drawings. The base assembly shall be of high tensile brass conforming to BSS 251C,(Grade A), The complete assembly shall be of proper strength to withstand the excessive wind pressure during storms.

2.3 Roof conductors copper strips shall be installed on parapets & surfaces of roof as shown in drawings with copper saddles, brass nuts & bolts. The copper strip shall be of 99.99% electrolytic copper conductor.

2.4 Copper strips shall be installed as down conductor on walls/columns between roof conductors and earth electrodes as shown in drawings, complete with copper saddles, brass nut bolts, proper bends. The copper strip shall be of 99.99% electrolytic copper conductor.

2.5 Earth electrode shall comprised of 25mm dia 6 meter long steel rod with 1mm copper conductor sleve of 99.99% imported copper rammed in 3” dia 6 meter long bore hole filled with 6 bags of earthing chemical including clamp with double nut bolts on top of rod and inspection pit, complete in all respects, as per specification and drawings.

2.6 Care must be given to ensure that when the copper strip is fixed there shall be no sharp bend and absolutely no upturns. Joints should be made with square clamps. These joints must be kept to minimum number. Test clamps should be provided for each down conductor near ground level. No joint in copper strip should be made below the test clamp, except at the earth terminal. The earth resistance for the entire lightning protection system, in no case, should exceed ten ohm.

2.7 All reinforcement steel of columns and slabs, where possible, shall be connected with the protective system. Metal pipes and other metal building components of structure, within 6 feet of down conductor should be bonded at the top and bottom, and also at intermediate position if directed at site.

2.8 All the instructions and safety measure should be adhered to at site. The Project Manager should be consulted at site if any changes due to site conditions are required to be made.

LPS.3 INSTALLATION INSTRUCTIONS.

All the relevant instructions contained in Section 18 are applicable to this section.

LPS.4 MEASUREMENT.

4.1 The arrestor and Earth point shall be treated a lumpsum job for the purpose of measurement.

4.2 CPC or tape for the same purpose shall be measured as actual length installed.

SECTION - 20 SOUND / MUSIC / PAGING SYSTEM

1.GENERAL:

The extent of works shown on the drawing does not indicate the exact position of conduits 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 conduit system shall be co-ordinate with manufacture's recommended accessories.

The quality and material for the accessories of conduits and pipes such as sockets, end cap, elbows, bushings, bends inspection/pull boxes, round boxes, etc., necessary for the complete installation shall be similar to that of conduits 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.

2. SCOPE OF WORK:

The Work under this section consist of supplying, Supplying, installing and commissioning of all material and services of the complete Conduits and Pipe as specified herein and/or shown on Tender Drawings and stated in the Bill of Quantities.

The contractor shall discuss the Public Address System layout with the Engineer and co-ordinate at Site with other services of exact route, location and position of the conduits and pipes.

The conduits and pipes with accessories shall also comply with the General Specifications for Electrical Works, Section-8001 and with other relevant provisions of the Tender Document

3. APPLICATION CODE:

The public address system shall be used for paging within the building or specified area. The system shall include the entire component and installing methods/materials required ensuring full compliance to the code of the practice and applicable part of BS standard.

4. SITE CONDITION:

The contractor supplier shall visit before submitting his quotation and acquaint himself with the site condition and check the specification design drawing and bill of quantity.

5. EQUIPMENT PROTECTION:

All equipment supplied shall confirm as a minimum to the following protection classes.

Ip-40

Ip-54

Ip-65

6. SYSTEM OPERATION

The suggested system shall be operated through a central Control System. The system based on its amplifier, which will drive and handle all the speakers, fitted in the building.

The characteristic of some of the equipment in brief is given below; however contractor / supplier shall provide the catalogue of each item for future details.

7. DETAIL OF EQUIPMENT

a. Voice Alarm Controller
b. Voice Alarm Router
c. Booster Amplifier
d. Ceiling Speaker
e. WALL Speaker
f. Column Speaker
g. Power Amplifier
h. Back Ground Music Unit
i. Call Station

VOICE ALARM CONTROLLER:-

Voice Alarm Controller should have following features:-

- Compliant with standards for emergency sound systems (IEC60849).
- 6 – Zone System Controller.
- Built-in 240 W Booster Amplifier.
- 12 Business and emergency control inputs and outputs.
- Line output for monitor or recording.

The Controller should have two BGM source inputs and a mic/line input with configurable priority, speech filter, phantom power and selectable VOX activation. A total of 16 priority levels can be specified for microphone, call stations and trigger inputs for optimum system flexibility.

The powerful 240W output section should be have six transformer isolated 100V constant voltage outputs for driving 100V loud speakers in six separate zones. All zones may be individually selected from the front panel, and the BGM output level in each

zone can be individually set in 6 steps. The BGM output is connected to the 70 V line, so it is possible to connect a total load of 480 Watts in a two-channel system combined with a 480 Watts

The out put of the Booster should also available as a separate out put o 100 V and 70 V.
A separate 100 V call only out put should be provided for addressing and area where BGM is not is not required but where priority announcements are. Six configurable volume override out put contacts should available for overriding local volume controls during priority calls. A LED VU – meter should monitors the out put up to 255 messages can be stored in the internal 16 MB flash ROM, without a need for battery backup

Technical Specifications

Electrical

Mains Voltage	230 / 115 VAC, ±10%, 50 / 60 Hz
Main Power Consumption	60 VA
Max/Rated output Power	360 W / 240 W
Battery Current	24 VDC, +20% / -10%
Max Mains Inrush Current	8A @ 230 VAC / 16A @ 115 VAC

Power Consumption

Mains Current	
System Idle	0.26 A = 60 VA
System Idle with Pilot Tone	0.6 A = 136 VA
Maximum Load8*)	3.6 A = 380 VA
24 V Current	
System Idle	0.9 A
Maximum Load*	14 A

Performance

Frequency Response	60 Hz – 18 kHz (+1/-3 dB, @ - 10 dB ref. rated output)
Distortion	<1% @ rated output, 1 kHz
Bass Control	-8/+8 dB @ 100 Hz
Treble Control	-8/+8 dB @ 10 Hz

Inputs

Mic / Line

Input Type	XLR, 6.3 mm jack
Sensitivity	1 mV / 1V
S/N	63 dB (flat at max volume)
S/N	75 dB (flat at min volume/muted)
Headroom	25 dB
Speech Filter	-3 dB @ 315 Hz, high-pass, 6 dB/oct
Phantom Power Supply	12 V
VOX Trigger Level	-20 dB (100 µV mic / 100 mV line) or via input contact
Limiter	Automatic

Electrical

BGM and PC Call Station

Input Type	Cinch stereo (converted to mono)
Input level	200mV – 2 V
Impedance	22 k Ohm
S/N	70 dB (flat at max volume)
S/N	75 dB (flat at min volume/muted)
Headroom	25 dB

Trigger Inputs 6 EMG, 6 business

Type	MC1,5/14-ST-3,5
Activation	Programmable
Supervision	on EMG inputs, Programmable
Supervision method	Series / Parallel resistor
100 V input	MSTB 2,5 /16-ST
Power Handling Capacity	480 Watts

Approvals and Compliance

Certifications and Approvals	
EMC emission	acc. to EN 55103-1
EVAC compliance	acc. to IEC 60849
EMC immunity	acc. to EN 55103-2
Safety	acc. to EN 60065

VOICE ALARM ROUTER:-

Voice Alarm Controller should have following features:-

- 6 EMG in put contacts
- 6 Business input contacts
- 6 Volume Override output contacts
- Supervision within the Voice Alarm System (compliant to IEC60849)

The Voice Alarm Router should be an expansion unit adding 6 zones as well as 12 inputs- and 8 out put contacts to the Voice Alarm System

able to use the built-in booster of the Voice alarm Controller, it should also provides out put and inputs for one or two boosters in a multi amplifier one-or two- channel system. It should provides dual channel operation for calls and BGM simultaneously to a maximum of six different zones, u

Technical Specification

Electrical

Main Voltage	230 VAC / 115 VAC, ± 15%, 50 / 60 Hz
Max Mains Power Consumption	50 VAC
Battery Voltage	20-26.5 V
Max Battery Current	1.8 A
Max Mains Inrush Current	1.5 A @ 230 CAC / 3A @ 115 VAC

Power Consumption

Mains Currnet

System Idle	0.2 A
Maximum Load	0.3 A
24 V Current	
System Idle	0.51 A
Maximum Load 24 V Output	1.5 A
Trigger Inputs	6 EMG, 6 business
Type	MC1, 5/12-ST-3, 5
Activation	Programmable
Supervision	On EMG inputs, programmable
Supervision Method	Series / parallel resistor
100 V Inputs	MSTB 2,5 /16-ST
Booster 1	100 V / 70 V/0V
Booster 2	100 V / 0 V
Power Handling Capacity	1000 Watts

Outputs

100 V/70 V Output	MSTB 2,5 / 16-ST, floating
100 V Outputs	1000 W rated per zone
Volume Override Type	3 wire, 4 wire (24 V), 4 wire failsafe

Output Contacts

All Contacts	
Connector Type	MC1,5/12-ST-3,5
Rating	250 V 7A voltage free
General Purpose Relays (2x)	NO / COM

Environmental

Operating Temperature	$+5^0$C to $+55^0$C
Storage Temperature	-25^0C to + 55^0C
Relative Humidity	<95%
Dimensions	88x430 x 260 mm

Booster Amplifier

Booster / power amplifier should have following features:

Performance

Frequency Response	50 Hz – 20 kHz (+1/-3 dB, @ - 10 dB ref. rated output)
	<1%@rated output power, 1 kHz

Inputs

Line input (3-pin XLR, 6.3mm phone jack, balanced)	
Sensitivity	1 V
Impedance	20 kOhm
CMRR	>25 dB (50 Hz – 20 kHz)
Line Input 1,2 (3-pin XLR, balanced)	
LBB 1938/00	
Sensitivity	1 V

Impedance	20 kOhm
CMRR	>25 dB (50 Hz – 20 kHz)
100 V Input (Screw, unbalanced)	
Sensitivity	100 V
Impedance	330 kOhm

Outputs

Line Loop-through Output 1,2 (3-pin XLR, 6.3mm phone jack, balanced	
Nominal Level	1 V
Impedance	Direct Connection to line input
Line loop-through Output 1,2 (3-pin XLR, balanced)	
LBB 1938/00	
Normal Level	1 V
Impedance	Direct connection to line input
Loudspeaker Outputs (Screw, floating)	
Output Power @ 24 V	
Battery Operation	-1 dB ref. rated power

Approvals and Compliance

EMC emission	acc. to EN 55103-1
EMC immunity	acc. to EN 55103-2

CEILING SPEAKER:-

Ceiling Speakers should have following features:-

Features

. Compact yet powerful
. Very wide opening angle
. Installation friendly
. Comply with international installation and safety regulations

Approval and Compliance

All plastic parts are manufactured from self-extinguishing high-impact ABS material (according to UL 94VO).

Safety	EN 60065
Water protected	acc. to EN 60529 IP x4

Technical Specifications

Max. Power	9 W
Rated Power (PHC)	6 W (6-3-1.5-0.75 W)
Sound Pressure Level at 6 W/1 W (at 1 kHz, 1 m)	96/88 dB (SPL)
Effective Frequency Range	60 Hz to 18 kHz(-10 dB)
Opening Angle	170^0 / 90^0 (at 1 kHz/4 kHz, -6 dB)
Rated Voltage	100 V
Rated Impedance	1667 ohm

Mechanical

Speaker Size	101.6 mm (4 in)
Magnet Weight	3.57 oz
Connection	2-pole push connector

Dimensions

Diameter	160 mm (6.30 inch)
Max. Depth	95 mm (3.74 inch)
Ceiling Thickness	9 to 25 mm (0.35 to 0.98 inch)
Mounting Cut-Out	145 mm (5.71 inch)
Color	off-white (RAL 9010)
Weight	690 g (1.52 lb)

Environmental

Ambient Temperature	-25^0C to +55 ^{0}C (-13 to 131 ^{0}F)

WALL SPEAKER:-

Cabinet Speaker should have following features:-

- Good speech intelligibility and background music reproduction
- Finished in white or black
- MDB Construction
- Available with or without integral volume control
- Complies with international installation and safety regulations

Technical Specification:-

Electrical

Maximum Power	9 W
Rated Power	6 W (6-3-1.5 W)
Sound Pressure Level at Rated Power/1 W (at 1 kHz, 1 m)	99/ 91 dB (SPL)
Effective Frequency Range	180 Hz to 20 kHz (-10 dB)
Opening Angle (at 1 kHz / 4 kHz, - 6 dB)	165^0 / 95^0
Horizontal	190^0 / 88^0
Rated input Voltage	100 V
Rated Impedance	1667 ohm

Environmental

Ambient Temperature	- 15^0C to + 55^0C

*) Technical performance data acc. to ICE 60268-5

COLUMN SPEAKER:-

Column Speaker should have following features:

- For sound Beaming in difficult reverberant conditions
- Excellent speech and music reproduction
- Adjustable bracket mounting
- MDF Construction
- Comply with international and safety regulations

Technical Specification:-

Electrical

Max. Power	36 W
Rated Power	24 W (24-12-6 W)
Sound Pressure Level at Rated Power/1 W (at 1 kHz, 1 m)	110/96 dB (SPL)
Effective Frequency Range	165 Hz to 16 kHz (-10 dB)
Opening Angle (at 1 kHz / 4 kHz, - 6 dB)	
Horizontal	190^0 / 88^0
Vertical	30^0 / 8^0
Rated input Voltage	100 V
Rated Impedance	417 ohm

Environmental

Ambient Temperature	- 15^0C to + 55^0C

POWER AMPLIFIER

The main function of the power amplifier is the amplification of audio signals for the signals. It shall be possible to select the out put voltage between 100V, 70V, 50V, by changing jumpers. The unit shall be certified to be complaint to IEC 60 849 and compliant to other relevant local standards. Should have the following Features

Mains voltage	115 Vac/230 VAC, ±10%, 50/60 Hz

Performance

Frequency Response	50 Hz – 20 kHz (+1/-3 dB, @ - 10 dB ref. rated output power,
Distortion	<1% @ rated output power 1 kHz
Bass Control	-8/+ dB @ 100 Hz
Treble Control	-8/+8 dB @ 10 kHz

Inputs

Input 1(5-pin DIN, balanced with phantom power, 6.3 mm phone jack)
input 2 (3-pin XLR, balanced with phantom power, 6.3 mm phone jack)

Sensitivity	1 m V
Impedance	>1 kOhm

S/N (flat at max volume)	63 dB
S/N (flat at min volume/muted)	>75 dB
CMRR	>40 dB (50Hz-20kHz)
Headroom	>25dB
Speech Filter	-3 dB @ 315 Hz, high-pass, 6dB/oct
Phantom Power Supply	16 V via 1.2 kOhm
VOX (input 1 only)	attack time 150 ms Release time 2 s

Input 3,4 (3-pin XLR, balanced with phantom power
6.3 mm phone jack)

Sensitivity	1 mV (microphone), 200 mV (line)
Impedance	>1 kOhm (microphone), >5 kOhm (line)
Dynamic Range	100 dB
S/N (flat at max volume)	>63 dB (microphone), >70 dB (line)
S/N (flat at min volume/muted)	>75 dB
CMRR	>40 dB @ (50 Hz-20 kHz)
Headroom	>25 dB
Speech Filter	-3 dB @ 315 Hz, high-pass, 6dB/oct
Phantom Power Supply	16 V via 1.2 kOhm (microphone)

Music Input (Cinch, stereo converted to mono)

Sensitivity	200 mV

Electrical

Impedance	22 KOhm
S/N (flat at max volume)	>70 dB
S/N (flat at min volume/muted	>75 dB
Headroom	>25 dB

Emergency/telephone (Screw, balanced)

Sensitivity	100 m V – 1 V adjustable
Impedance	>10 kOhm
VOX	threshold 50 mV Attack time 150 ms Release time 2 s
S/N (flat at max volume)	>65 dB

Interconnection (Cinch)

Nominal Level	1 V
Impedance	>10 kOhm

Outputs

Master output (3-pin XLR, balanced)

Nominal Level	1 V
Impedance	‹100 ohm

Tape Output (Cinch, 2x mono)

Nominal Level	350 mV

Impedance		1.5 kOhm
Interconnection (Cinch)		
Nominal Level	1 V	
Impedance		‹100 ohm
Loudspeaker outputs (Screw, floating)		

Environmental

Operating Temperatue	-10 °C to +45 °C
Storage Temperature	-40 °C to +70 °C
Relative Humidity	‹95%
Acoustic Noise Level of Fan	‹40 dB SPL @ 1m

BACK GROUND MUSIC & PAGING UNIT:-

Back ground music & Paging unit should have the following features:-

- All-in-one solution for back ground music & paging.
- CD player for Audio and MP3 CD/CD – R.
- FM/AM Tuner with 15 presets and Digital Control.
- Dual Zone 120W Mixer Amplifier with volume control per zone.
- Selectable priority and vox switching on microphone input.
- The powerful 120W out put section has two transformer isolated 100V Constant Voltage out puts for driving 100V Loud Speakers in two separate zones.
- The announcement part of the unit has 3 microphone input

Approvals and Compliance

Safety	acc. to EN 60065
Immunity	acc. to EN 55103-2
Emission	acc. to EN 55103-1

Technical Specifications

Mains power supply

Voltage	230/115 VAC, ±15%, 50/60 Hz
Max power consumption	25 VA

DVD/CD-Player

Frequency response	2 Hz to 20 kHz (+ 1/-3 dB)
Distortion	<0.1%
S/N	>96dB

MP3

MP3 bit rates	CBR 32 to 320 kbps and VBR, mono and Stereo
Data buffer shock protection	32 MB
Lifetime	>10,000 play cycles

Tuner

Frequency response	30 Hz to 15 kHz (+1/-3dB, FM)
Distortion	<1%

Mains power supply

S/N	>63 dB (1mV, FM)

DVD/CD player outputs 2x

Connector	Cinch, (RCA) stereo
Nominal level	500 mV
Optical output	To Slink (PCM, multi channel)
Supported formats	DVD, CD (re-) writable MP3, MP4, JPEG

Mixed output 1x

Connector	Cinch, (RCA) stereo
Nominal level	200 mV

Video outputs

Component connectors	3 x cinch
Composite connector	1 x cinch
S-Video connector	1 x mini-DIN

Tuner frequency range

Range	FM	87.5 – 108 MHz (Europe, 50 kHz) 87.5 – 108 MHz (Asia/America, 100 kHz)
	AM	531 – 1602 kHz (Europe, 9 kHz) 530 – 1610 kHz (Asia/America, 10 kHz)
Sensitivity		
	FM	2µV (26 dB S/N)
	AM	30µV (20 dB S/N)

Environmental

Operating temperature	-10 ^{0}C to +55 ^{0}C (14 ^{0}F to + 131 ^{0}F)
Storage temperature	-40 ^{0}C to +70 ^{0}C (-40^{0}F to + 131 ^{0}F)
Relative humidity	<95%

CALL STATION:-

The call station is used for making a manual or pre recorded call to any pre-assigned zones or executing a pre-defined action. The Call station should have the Following Features.

Features

. Stylish 6-zone call station, intended for LBB 1990/00 voice Alarm System Controller
. Six zone selection keys, all-call key and momentary PTT-key for calls
. Selectable gain, speech filter and limiter for improved
. intelligibility
. LED indications for zone selection, fault and emergency state
. Call station extension provides 7 additional zone and zone group keys

Technical Specification

Power supply

Voltage Range	18 – 24 V 24 V by LBB 1990/00 Or external power supply
Current Consumption	<30 mA Call Station <15 mA key Pad

Performance

Nominal Sensitivity	85 dB SPL (gain preset o dB)
Nominal Output Level	700 mV
Maximum Input Sound Level	110 dB SPL
Gain Preset	+6/0/-15 dB
Limiter Threshold	2 V
Compression Ratio Limiter	20 : 1
Distortion	<0.6% (maximum input)
Equivalent Input Noise Level	25 dB SPLA
Frequency Response	100 Hz – 16 kHz
Speech Filter	-3 dB @ 315 Hz, high-pass, 6 dB / oct
Output Impedance	200 ohms
Selections	

Environmental

Operating Temperature	-10 °C to +55 °C
Storage Temperature	-40 °C to +70 °C
Relative Humidity	<95%

Conduiting and Wiring Installation Work

Galvanized Iron (G.I) Pipes and Accessories

Galvanized iron pipes shall be used on surface or underground installation wherever specified and required at entry into manholes and as shown on drawings.

The underground G.I. pipes and accessories shall be provided with one thick coat of bituminous paints on the outer surface prior to installation.

PVC Conduit and Accessories for Indoor

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 shall have minimum dimensions of 63 mm diameter and depth. Wall junction boxes shall have minimum dimensions of 63 mm deep. Round junction boxes means of brass screws

Pull and Adaptable Boxes

Inspection/Pull boxes and 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 inspection/pull boxes or adaptable boxes. However, these shall be as per Engineer's approval.

Cable for Public Address Systems

The cables shall be PVC insulated, PVC sheathed twisted pair screened cooper conductor conforming to IEC

The PVC insulation shall comply with BS 6746. The conductor shall be tinned sold high conductivity soft annealed copper complying with 6360. The insulation of conductors shall be colour coded as per above-mentioned publications.

All wires and cables shall be color-coded tagged and checked for open short or ground terminals blocs of proper size and type for the services involved cable joints shall only be allowed on speaker and

Rack

Suitable mounting rack for head and equipment with adequate ventilation to fixing of all controlling equipment .

Testing & Commissioning

On completion of the work and before commissioning of the equipment. The entire PA /sound system including wiring shall be tested and commission by the supplier / contractor engineer and test performance result to be submitted to client / user and system commission report.

Maintenance & Warranty

The supplier / contractor shall be responsible for all equipment by him and warranty the time for a period of twelve month form the date of commissioning certificate.

Training

The supplier / contractor shall p

SECTION - 21 CCTV SYSTEM

CCTV1 **SCOPE OF WORK**

The work under this section consists of , installation, testing and commissioning a complete closed circuit television (CCTV) system as stated herein and as per B.O.Q..

CCTV.2 **GENERAL**

All equipment provided under this section shal conform to relevant European / American standard i.e. CE & UL listed..

CCTV.3 **SYSTEM**

The system shall provide color CCTV surveillance of specified areas by means of color CCD cameras. The Control Contain the color monitor with Digital Video Recorder.

CCTV.4 **EQUIPMENT.**

4.1 Camera.

Compact rugged, 1/3 inch image format digital color CCD cameras having a resolution of 752 (horizontal) by 582 (vertical) pixels is specified. The Camera shall conform to the CCIR – standard. The camera shall be of compact ragged design, high sensitivity advance digital signal processing high resolution with outstanding picture quality extended sensitivity with night sense.

The camera shall require only 1.0 lux for useable video. All the control shall be concealed. Other standard features shall be back light compensation, automatic shutter, selectable electronic shutter, digital adjustment control, automatic white balance and insulation installation.

The camera shall be line locked to the power line zero crossing to ensure roll free vertical interval video switching and recording.' A vertical phase adjustment potentiometer shall be accessible through an opening in the side *of* camera to allow for camera synchronization in multi phase power installation.

The rated voltage shall 12VDC, 24VAC, 50 Hz. The operating temperature shall be -20 to 50 degrees Celsius. Humidity shall be 5 to 93 % non-condensing. Shock resistance shall be minimum 50 gm.

Signal-to-Noise Ratio:	50 db with AGC : 21 dB (Max.)
Electronic Shutter:	Automatic, 1/50 to 1/125,000 – sec.
White Balance:	Automatic Sensing, (2500 – 9000 K)
Video Output	Composite video 1.0 Vpp, 75 ohms)

The camera should have an on-screen menu with following controls.

Video Level		
AGC:	:	On / Off
BLC	:	On / Off
ATW	:	On / Hold
Shutter	:	AES/ off / Flicker less.
R – Offset		
B – Offset		
V – Phase Adjustment:		0 –358 Degrees

4.2 **Auto Dome Camera.**
The camera should consist an imager *of* 1/3" IT CCD with a resolution *of* (752 x 582 " PAL) / (768 x 494 NTSC). Having a lens *of* 25 x zoom (2.4 -:- 60 mm) F 1.6 to F 27. It ' should consist an automatic with manual override. Focus and iris adjustment with a field of view *of2.0* degree to 45 degree

The camera should be operational between -40 degree C to 50 degree C under 100% relative condensing humidity, the ingress protection should be less than IP 66 (NEMA 4X)

The camera should be able to PAN 360 degree continues and tilt from horizontal plane 5 degree to 90 degree during a guard tour the camera speed should be 360 degree per second, ISO accuracy and having a variable speed *of* 120 degree per second.

The camera should be capable *of* creating 16 independent sector with 16-character title. The camera should be remotely controlled through either biphase or via RS-232. Pre position should be atleast 99 each with 16-character title.

The camera can create two types of tours one recorded tour with totally 15 min during both and the preset tour that consist up to 99 scenes consecutively. The camera should be able to fast addressing or 4 digit thumb wheel.

The camera must have the following specification.

Video output	:	1.0 Vp-p ; 75 ohms
Gain control	:	off / auto (with adjustable limit)
Synchronization	:	line lock (-120 to 120 degree vertical phase adjust) or internal crystal
Aperture Correction	:	horizontal and vertical
Digital zoom	:	12 X
Horizontal resolution	:	470 TVL (NTSC) / 460 TVL (PAL)

Sensitivity (usable video)	
Day mode w/slow shutter off	0.2 fc / 2.0 Lx
Night mode w/slow shutter on	0.025 fc / 0.25 Lx
Day mode w/slow shutter on	0.013 fc / 0.13 Lx
Night mode w/slow shutter off	0.0016 fc / 0.016 Lx

4.3 AUTO DOME CONTROLLER:

Auto Dome Controllers provide complete Control of the Auto Dome System features is as:

- Operates upto 8 Controllable Cameras in daisy -Chain Configuration.
- Controls All Dome system features including Auto play back
- Ergonomic layout for single-handed Control.
- Full pan/tilt/zoom operation
- 22, key control unit with integral vector solving 'pan/title/zoom/joy stick, interface box and appropriate power supply.

4.4 CCTV'MONITOR

Color Monitor is multi standard compatibility with a Built - in loud speaker and in puts able to accept NTSC, PAL and S-video standards in 450 TV line of Horizontal resolution is housed in a compact, space-saving metal cabinet for, rugged reliability.

4.5 Digital Video Recorder:

- Digital video recorder should have the following features. ~ Combined multiplexer & digital video recorder.
- 240 fps recording (PAL/NTSC)
- Simultaneous recording & play back.
- Remote operation via the control center.
- Intuitive user face.
- Storage capacity of upto 7 day recording

4.6 VIDEO CABLE

The Low loss video cable RG - 6 are 75 ohms coaxial cables suitable for use in close circuit television system. The specifications adopting such design is mentioned below.

- The conductor shall be copper.
- The insulation comprises of foamed polyethylene resulting in low attenuation.
- Cable is then provided with screen and overall covered with black PVC compound.

4.7 POWER CABLE ,

PVC insulated PVC sheathed unarmored multicore 600 '/ 1000 volts grade with standard copper conductors according to latest standard specification.

4.8 LENSES

Lenses shall be of C and CS mount and following types.

1. 4 or 8 mm fixed focal length and manual iris lens.
2. 3.5 - 8 mm varifocal auto iris lens.

4.9 RACK.

The rack shall house monitors, Digital Video Recorder. It shall be of 19" standard mounting system, all material casing with front glass Qoor. All racks shall be supplied with lock & key arrangement.

5. TESTING & COMMISSIONING.

All the normal test as recommended by the manufacturer shall be carried out on the system. The system shall be commissioned by the authorized personnel only.

SECTION – 22 M.A.T.V. SYSTEM

1.0 GENERAL

The Contractor shall supply, install, test, Commissioning, guarantee and maintain a modern Master Antenna Television (SMATV) system for the distribution of combined IF-RF signals. The system shall be capable of receiving and distributing the present Television and Radio transmission with sufficient allowances made to include any future transmissions within the foreseeable future, without degrading of the system parameters.

The system shall receive the off sir VHF and UHF channels and shall process and distribute them to TV/FM outlets. The system shall include, but not limited to dishes, antennas, antennas mast, head-end cabinet, amplifiers, convertors, combiners, filters, distribution equipment, cables, connectors, tap-offs, splitters, TV outlets, etc.

The system shall be from an approved manufacturer, supplied and installed by a specialist Contractor, who shall have trained staff to undertake the work.

The contractor shall submit a complete proposal with schematic drawings with signal level calculations, list of materials and originals detailed catalogues of the equipment for approval before starting the work.

A pre planning site survey will be performed to assess the signal strength and also take in to account the site related factors for performance of system

1.3 Submittals

- Signal survey report.
- Data of system/components with complete technical literature
- Shop drawings.
- Certificate of Country of Origin

2.0 TECHNICAL REQUIREMENTS

2.1 System Description

The system design shall meet and fully comply with the following performance and operational requirements.

2.1.1 The system shall consist of a Centralized MATV system suitable for receiving TV and FM channels and also transmitting in-house videos over the same network. The system shall be designed to operate on 24/7 basis.

2.1.2 The system shall be for a range of up to 1000 MHz with a signal strength of 60-80 dB micro-volts at user outlet.

2.1.3 The signal to noise ratio shall be 40 dB for the TV signals. A difference of 3 dB shall be maintained between adjacent channels.

2.1.4 Channel convertors shall be provided to avoid interference from terrestrial TV signals.

2.1.5 The selection of channel separation shall be made to avoid any interference and quality of signal.

2.1.6 All outputs of devices shall be provided with a termination resistor as recommended by the system manufacturer.

2.1.7 Connectors shall be F type.

2.1.8 The system shall be powered by regulated DC power supply operating on 220-volt, 1 phase ac supply from a UPS source.

3.0 SYSTEM COMPONENTS

The principal characteristics of the system equipment are stated in following sections. However it shall be the responsibility of MATV system supplier to select equipment that will provide best performance, for which consultant approval will be obtained.

3.1 Satellite Dishes

The dishes shall be of aluminium provided with supports to sustain a wind velocity of 160 KPH. The dishes shall be of specified diameters. These will be provided with suitable LNBs; selection of satellites shall be done during execution stage.

3.2 Antenna

The antenna shall receive the UHF/VHF and FM signals and installed to sustain a wind load at a velocity of 160 KPH. The antenna shall have a BALUN for the required output level. The antenna shall have the following features:

- Number of UHF channels - 36
- Return Loss - 10 dB minimum
- F/B ratio - As appropriate for VHF and UHF signals
- Material - Aluminium with SS accessories

3.3 Amplifier

3.3.1 The power amplifiers shall have the following characteristics.

- Output level - 40 dBmV for 36 channels
- Slope control range - 0-8 dB
- Gain control - 10 dB

3.3.2 Cascading of amplifiers shall be considered where required by the signal level.

3.3.3 Amplifiers shall have surge protection.

3.3.3 One amplifier shall be installed as spare.

3.4 Pre-Amplifiers, Convertors, Filters, Modulators

These components of the system shall be selected based on the recommendations of system manufacturers for best possible performance of the system. Details shall be submitted with supporting calculations/justifications for approval of consultant.

3.5 Splitter

The splitter unit shall be in a shielded metal housing and provide multiple isolated outed from a single input and vice versa. The splitter shall comply with the following:

- Slitter loss - Maximum 12 dB for 8 way, 7.5 dB for 4-way

3.6 Receiver Wall Outlets

- The outlet shall be combined for receiving TV and FM signals.
- Outlets shall screw on cable connectors.
- The outlets shall have the same design and finishes as the other electrical wiring accessories. A metallic box shall be provided for flush mounting of the outlet.
- Where required, termination device shall be provided with outlets.

3.7 Cable

- Cable shall be RG6 double shielded type with jacket.
- Conductor - 18 AWG
- Di-electric - Foam
- Return Loss - 28 dB
- Suitable for the entire frequency range of the system.

5.0 INSTALLATION, TESTING & COMMISSIONING

5.1 Power supply for the system shall be Alternating Current at 230V 50Hz, and connected to the building UPS. It shall automatically switch on to batteries in case of mains power failure before the essential power line's generator kick-in to supply power. The standby battery supply shall provide sufficient

power and enable the fully loaded system, announcement at the maximum level, to continue operating without interruption for a minimum duration of 1/2 hour should mains power fail.

5.2 All equipment shall be mounted into a 19” EIA standard equipment rack.

5.3 The contractor shall submit a detailed testing and commissioning plan and procedures and checklist, which shall be designed to verify the full compliance of the installed system with these specifications. The T&C plan and procedures shall be submitted to the Consultant for approval.

5.4 Functional test on the system shall be performed following the completion of the installation. The functional tests shall include signal measurements at outlets and actual quality of reception.

The contractor shall provide all facilities/test measurement equipments. Records, chart, etc. of the T&C shall be documented as part of the installation documentation.

SECTION – 23 UNINTERRUPTIBLE POWER SUPPLY (UPS)

UPS. 1 **Summary**

This specification describes as three-phase, on-line, continuous operation, solid-state uninterruptible power supply (UPS). The UPS shall operate as an active power control system, working in conjunction with the building electrical system to provide power conditioning and on-line power protection for the critical loads.

UPS.2 **Standards**

A. Safety: EN/IEC 62040-1.
B. EMC/IEC 62040-2 (Class C2 and C3).
C. Performance: EN/IEC 62040.

UPS.3 **Classification**

A. Classification according to EN/IEC 62040-3.

UPS.4 **Submittals**

A. **Product data**: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications.

1. Bill of materials for the proposed system.
2. Product catalogue sheets or equipment brochures.
3. Product guide specifications.
4. System single-line operation diagram.
5. Floor layout/footprints.
6. Installation guide.
7. Drawings for requested optional accessories.

B. Operation and Maintenance Data

Submit operation and maintenance data to include in operation and maintenance manuals specified in (division 01-GENERAL REQUIREMENTS) (Division 1-GENERAL REQUIREMENTS), including, but not limited to, safe and correct operation of Ups function.

1. Submit an installation manual, which shall include, but shall not be limited to, instructions for storage, handling, examination, preparation, installation, and start-up of all systems.

2. Submit an operation and maintenance manual, which shall include, but shall not be limited to, operating instructions.

3. Submit equipment drawings, dimensions and schematics.

UPS.5 **Quality Assurance**

A. **Qualifications:**

1. **Manufacturer Qualifications:** Manufacturer shall be a firm engaged in the manufacture of solid state UPS of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 20 years.
   a. The manufacturer shall be ISO 9001 & 14001 certified and shall be designed to internationally accepted standards.

UPS.6 **Manufactures**

A. Basis of Design: Items specified are to establish a standard of quality for design, function, materials, and appearance. Only the products from the approved manufacturers are acceptable. The Architect/Engineer will be the sole judge of the basis of what is equivalent. Examples of modifications include, but are not limited to the following:

1. Structural reinforcement to accommodate heavier equipment.
2. Increased sizes of circuit breakers, raceways and wiring.
3. Larger back-up generators (including upgraded accessories and wiring) to avoid instability caused by most double conversion UPS system.
4. Larger HVAC equipment (including duct work and wiring) to accommodate increased heat dissipation of less efficient UPS systems.
5. Filters to prevent input distortion, avoid upstream equipment malfunction and failure of power factor equipment.

UPS.7 **Description**

The UPS shall consist of the following easy to repair modular rectifier/inverter sections and easy to install internal and external modular battery units.

a. The UPS shall be provided with separate fees for rectifier/inverter section and the static bypass switch.

b. Modes of operation: The UPS shall operate as an on-line system in the following modes:

1. **Normal:** The inverter and the rectifier shall operate in an on-line manner to continuously regulate the power to the critical load. The rectifier shall derive power form the AC input source and supply DC power to float charge the battery.

2. **Battery:** Upon failure of the AC input source, the critical load shall continue being supplied by the inverter without any switching. The inverter shall obtain its power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the AC input source.

3. **Recharge:** Upon restoration of the AC input source, the UPS shall simultaneously recharge the battery and regulate the power to the critical load.

4. **Static Bypass:** The static bypass switch shall be used for transferring the critical load to input supply without interruption. Automatic re-transfer to normal operation shall also be accomplished with no interruption in power to the critical load. The static bypass switch shall be fully rated and shall be capable of manual operation. The UPS shall be able to recharge the batteries while supplying full power to the load via the static bypass switch.

5. **Internal maintenance bypass:** The UPS shall be provided with an internal manual bypass to simplify the installation and shall be used for supplying the load directly from the mains supply, while the UPS is taken out for maintenance.

UPS. 8 **Static UPS**

A. **General:** The UPS shall be housed in a freestanding enclosure. The enclosure shall be designed to blend into an IT environment. The cabinet shall be equipped for fork truck lifting. The UPS cabinet shall be painted with the manufacturer's standard color. All service access shall be from the front. Installation access shall be from the lower backside of the system.

1. The UPS shall be in a self contained cabinet and comprise of two 20 kVA power sections; Bypass Static Switch; Battery for standard run time and interface LCD display all mounted in a separate cabinet. The UPS shall permit user installable and removable battery units.

   The power section shall be of the Double Conversion On-Line topology with power factor corrected inputs.

   a. The UPS battery shall be sized for desired kVA Ratings at a power factor of 0.8 for 10 minutes (minimum).

2. The UPS shall have a short circuit withstand capability of 30 KA.

UPS.9 **Component Description**

A. **Rectifier**

1. Each UPS power module shall include an active power factor corrected, insulated Gated Bipolar Transistor (IGBT) rectifier.
2. The input current limiter must be design to support 100% load, charge batteries at 10% of the UPS output rating, and provide regulation with mains deviation of up/down to +/-15% of the nominal input voltage. During an overload condition the input current must be limited to maximum 125% of the nominal output current.
3. The battery charging shall keep the DC bus float voltage of +/-219V, +/-1%.
4. DC ripple voltage shall be less than $\pm$1% of nominal with no battery connected.
5. Input power factor shall be 0.9(min.) lagging at 100% load without the use of passive filters.
6. Rectifier shall employ electronic waveform control technology to maintain the current sinusoidal.
7. Pulse Width Modulation (PWM) current control shall be used. Digital Signal Processors (DSP) shall be used for all monitoring and control tasks. Analog control is not acceptable.
8. Reflected input current Total Harmonic Distortion (THD) shall not exceed 5% at 100% load.
9. Typical battery re-charges time as per IEEE 485.

B. **Batteries**

1. Standard battery technology shall be Dry Sealed Maintenance Free.
2. Batteries shall be housed in the same rack as the power section. Batteries shall be modular on pull out shelves for quick replacement and servicing.

3. Battery voltage shall be Battery Temperature Compensated as outlined in the rectifier section above.
4. **End of discharge:** 150VDC.
5. For longer runtimes, external battery frames in the same design may be offered.
6. **Battery Charge Current Limit:** The UPS shall be capable of limiting the energy sourced from the mains for purposes of battery charging. As a default setting, the battery charge energy will be set to 100% of its nominal value. When signaled by a dry contact, (such as from an emergency generator) the UPS shall be capable of limiting the battery charge energy taken from the mains. This shall take place in user selectable increments of 75%, 50%, 25%, 10% and 0% of the nominal charge power. The selection shall be made from the UPS front panel display/control unit.

7. The battery charging circuit shall remain active when in Static Bypass and in Normal Operation.
8. The batteries charger shall allow cyclic charging when system is running in normal operation and batteries are full charged to extend the battery life. This operation shall be selectable in the display. Cyclic charge should be 10 hours on and 48 hours off. The Cyclic charge shall end if UPS is overloaded, switch to battery operation, battery voltage drops below 200V or are deactivated by user.

C. **Inverter**

1. The inverter shall consist of fast switching IGBT power module.
2. Inverter shall be PWM controlled using DSP logic. Analog control shall not be acceptable.
3. The inverter modules shall be rated for an output power factor at 0.8.
4. Nominal output voltage shall be 1x230 V and adjustable for 1x220 V or 1x240 V, 50 Hz, L1,N, PE.
5. **Efficiency of each module at full load:** not less than 92% (minimum).
6. **Output Voltage Total Harmonic Distortion at full load:**
   a. Less than 1.5% for 100% resistive load.
   b. Less than 3.5% for computer load as defined by EN50091-3/IEC 62040-3.
7. **Output voltage regulation:**
   a. **Static:** Less than 1% at full linear load.
   b. **Dynamic:** 5% at 100% step load.

8. Output frequency: 50 Hz free running.

9. **Crest factor:** Unlimited but regulates it down to 2.7.
   a. Remote Emergency Power Off (EPO) shall be standard (wall switch and wiring shall be provided by the electrical contractor).

D. **Static Bypass Switch**

1. The static switch shall consist of fully rated Silicon Controlled Rectifiers (SCRs). Part rated SCRs with a wrap around contactor are not acceptable.

2. **The static bypass switch shall be automatically transfer the critical load to bypass input supply without interruption after the logic senses one of the following conditions:**

   a. Inverter overload beyond rating.
   b. Battery runtime expired and bypass available.
   c. Inverter failure.
   d. Fatal error in control system.

3. The static bypass switch shall automatically retransfer from bypass to the inverter, when one of the following conditions occurs:

   a. After an instantaneous overload-induced transfer has occurred and the load current has returned to less than 100% of the system rating.
   b. The inverter is active (on).

4. The static bypass switch shall be equipped with a manual means of transferring the load to bypass and back to inverter.

5. If more than 10 transfers from and to inverter occur in a 1 minutes period, the load shall be locked on static bypass. An alarm communicating this condition shall be annunciated.

E. **Mechanical**

1. The UPS power section, Static Bypass Switch, internal manual bypass switch and the DRY SEALED MAINTENANCE FREE batteries (for standard runtimes) shall be housed in a freestanding enclosure. The enclosure shall be designed to blend into an IT environment. The UPS cabinet shall be painted with the manufacturer's standard color. All service access shall be from the front. The enclosure shall have the following specifications.

   a. Heavy-duty design with an all-metal construction.
   b. Caster fitted for mobility. Leveling feet shall be supplied as standard.
   c. Electrostatic applied paint.
   d. The cable entry shall be from the bottom on the back of the UPS.
   e. The UPS enclosure shall meet an ingress level of min. IP52.
   f. The UPS should be fitted with dust filter in the air inlet to filter dust, molds and spores with particles larger than 3 m.

UPS.10 **<u>System Controls and Indicators</u>**

A. **General:** A microprocessor controlled display unit shall be located on the front of the system. The display shall consist of an

alphanumeric display with backlight, an alarm LED, and a keypad consisting of pushbutton switches.

1. **The following metered data, shall be available on the alphanumeric display but shall not limited to:**

    a. Time record of occurring events.
    b. Input AC voltage.
    c. Output AC voltage.
    d. Output Ac current.
    e. Input frequency.
    f. Battery voltage.
    g. Highest internal battery temperature.

2. The display unit shall allow the user to display an event log of all active alarms and of the 50 most recent status and alarm events (minimum).

3. **For purposes of remote communications with the UPS the following shall be available and contained within the UPS on a removable, "hot swappable" "smart slot" interface card:**

    a) RJ-45 Interface port for remote communications with a network via web browser or SNMP.

    b) Environmental monitoring feature, capable of locally monitoring temperature and humidity as well as two additional generic set of user determined dry contacts capable of taking an input signal from any third party on/off signal, such as water detection, smoke detection, motion, or fire detection.

UPS.11 **Battery**

A. The UPS battery shall be of modular construction made up of user replaceable, hot swappable, fused, battery modules. Each battery module shall be monitored to determine the highest battery unit temperature for use by the UPS battery diagnostic, and temperature compensated charger circuitry.

B. The battery blocks housed within each removable battery module shall be of the Dry Sealed Maintenance Free type.

UPS.12 **Accessories**

A. **Extended runtime (XR) option**

1. For purposes of extending the UPS battery runtime, external extended runtime options shall be available. The extended runtime option shall be housed in "line up and match" type enclosures and shall contain necessary hardware and cables to connect to the UPS, or between enclosures. Each XR enclosure shall be equipped with removable, hot swappable, battery units housed in draw-out cartridges.

2. The extended runtime system shall have a 250 V DC rated, thermal magnetic trip molded case circuit breaker. Each circuit breaker shall be quipped with shunt trip mechanisms and 1A/1B auxiliary contacts. The circuit breakers are to be

equipped as part of a line-up-and match type battery enclosure.

B. **Software and connectivity**

1. The Ethernet Web/SNMP Adaptor shall allow one of more network management systems (NMS) to monitor and manage the UPS in TCP/IP network environments. The management information base (MIB) shall be provided in DOS and UNIX formats. The SNMP interface adaptor shall be connected to the UPS via the RS232 serial port on the standard communication interface board.

2. The UPS, in conjunction with a network interface card, shall be capable of gracefully shutting down one or more operating systems during when the UPS is on reserve mode.

3. The Ups shall also be capable of using an RS232 port to communicate by means of serial communications to gracefully shut down one or more operating systems during an on battery situation.

C. **Remote UPS monitoring:** The following three methods of remote UPS monitoring shall be available.

1. Web Monitoring: Remote monitoring shall be available via a web browser such as Internet Explore.

2. RS232 monitoring: Remote UPS monitoring shall be possible via either RS232 or contact closure signals from the UPS.

3. Simple Network Management Protocol (SNMP): Remote UPS Monitoring shall be possible through a standard MIB II complaint platform.

D. Software compatibility: The UPS manufacturer shall have available software to support graceful shutdown and or remote monitoring for the maximum prevailing operating system.

UPS.13 **Measurement**

This job shall be treated as lum sum job for measurement purposes.

UPS.14 **Payment**

Payment shall be made for each UPS as specified in the Bill of Quantities.

SECTION - 24 TESTING & COMMISSIONING

T.1 GENERAL.

Upon completion of the installation the contractor shall perform field tests on all equipment, material and systems. All tests shall be conducted in the presence of the Engineer for the purpose of demonstration equipment or system compliance with specifications.

The contractor shall furnish, install and maintain all tools, instruments, test equipment, material, connections, etc., and furnish all personnel including supervision and 'Stand by" labour required for the testing, setting and adjustment of all electrical facilities and their component parts, including putting the same into operation.

All tests shall be made with the proper regard for the protection of the equipment, and the contractor shall be responsible for adequate protection to all personnel during such tests.

The contractor shall record all test values of the tests made by him on all equipment, giving both "as found" and 'as left" conditions. Three (3) copies of all test data shall be given to the Engineer for record purposes.

The witnessing of any test by the Engineer do not relieve the contractor of his guarantees for materials, equipment and workmanship as specified in the Conditions of Contract.

T.2 INSULATION TESTS.

Insulation resistance tests shall be made on all electrical equipment, using a self-contained instrument such as the direct indicating ohm-meter of the generator type direct current potentials shall be used in these tests shall be as follows :-

Circuit under 230 volts - 500 volts test.

Circuit 230 volts to 400 volts-1000 volts test.

The minimum acceptable insulation resistance value will be 5 Megaohms.

The test equipment for insulation testing will be furnished by the contractor.

Before making connections at the ends of each cable run, the insulation resistance test of each cable shall be made. Each conductor of a multicore cable shall be tested individually to each other conductor of the group and also to earth. If insulation resistance test readings are found to be less than the specified minimum in any conductor, the entire cable shall be replaced and the new cable tested.

All transformers, switchgear shall be given an insulation resistance measurement test to ground after installation but before any wiring is energized. 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 that specified above, the cause of the low reading shall be determined and removed. Corrective measure shall include dryout procedure by means of heaters if equipment is found to contain moisture. Where corrective measures have been necessary and the insulation resistance reading taken after the correction has been made it should satisfy the requirements specified herein. Repeated insulation resistance maintenance test shall be made twice and at least 12 hours apart. The maximum range for each reading on the 3 successive tests shall not exceed 20% of the average value. After all tests have been made successfully , the equipment shall be reconnected.

T.3 **EARTH RESISTANCE TESTS.**

Earth resistance tests shall be made by the contractor on the earthing system, separating and re-connecting 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 ECP 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.

T.4 **TRANSFORMER & SWITCHGEAR.**

In addition to the insulation resistance tests on the transformer , a polarity or phase rotation test shall also be made. Auxiliary devices , breather, bucholz relay etc. shall be tested for satisfactory operation.

Each air circuit breaker shall be operated electrically and mechanically , ascertaining that handle mechanisms are operating . All interlock control circuit shall be checked out for proper connections in accordance with the wiring diagrames given by the manufacturer.

The contractor shall identify the phase of all switchgear and power cables by stenciling the switchgear and tagging the cables so that the phases can be identified for connections to give proper phase sequence.

Series overcurrent trip elements shall be checked against rating of equipment served. Also to checked for correct size, function of fuses disconnect switches, number of inter locks indicating lights, alarms and remote control devices. Name plates shall be checked for proper designation of equipment served.

T.5 **OPERATING TESTS.**

Current load measurement shall be made on equipment and on all power and lighting feeders.

The current reading shall be taken in each phase wire and in each neutral wire while the circuit or equipment is operating under actual load conditions. Clip-on ammeters may be used to take current readings. All light fittings shall be tested electrically and mechanically to check whether they comply with the standard of specifications. Fluorescent light fittings shall be tested so that when functioning properly no flickering is observed or choke noise is heard.

The lightning protection system shall be tested for earth resistance and for electrical and mechanical joints. The combined resistance to earth to the whole lightning protection system shall not exceed 5 ohms.

The alarm system, telephone system, sound distribution system shall be checked and tested as per manufacturer's instructions and in the presence of the Engineer or his representative .

After any equipment has been tested , checked for operation etc., and is accepted by the Owner's representative the contractor shall be responsible for the proper protection of

such equipment for assurance that subsequent testing of other equipment of system do not disturb the completed work.

BUILDING INTERIOR WORKS FOR EXTENSION OF PIEDMC HEAD OFFICE AT SUNDAR INDUSTRIAL ESTATE

Contract # PIE/P&C/HO/25/32

Commented [N1]: Please update

ARCHITCTURAL DRAWINGS
VOLUME-IV

June 2025

ARCHITECTURAL DRAWINGS

PROJECT: EXTENSION OF PIEDMC HEAD OFFICE IN SUNDAR INDUSTRIAL ESTATE

CLIENT: PIEDMC

ADDRESS: SUNDAR INDUSTRIAL ESTATE, LAHORE

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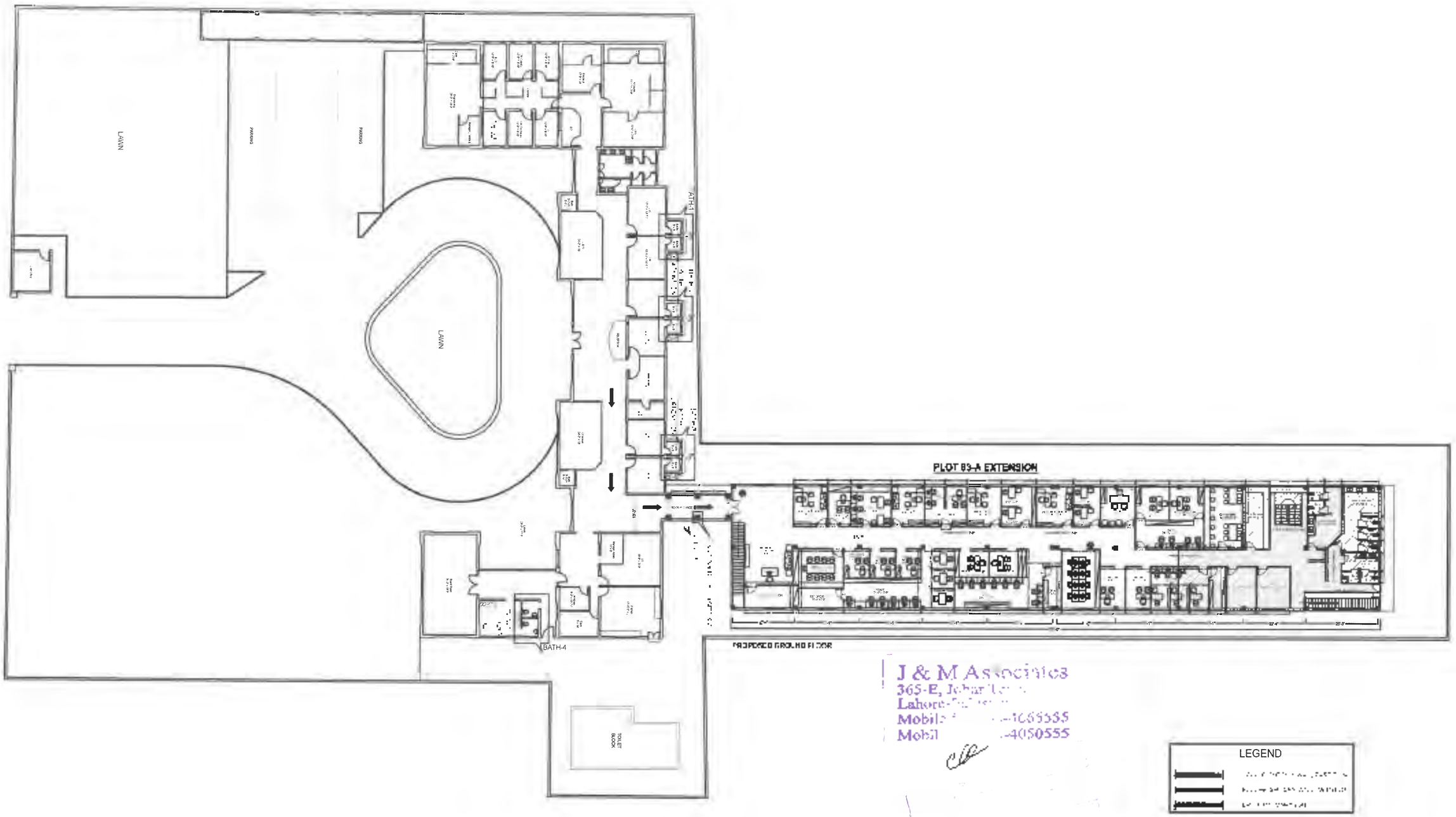

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365-E, Johar Town
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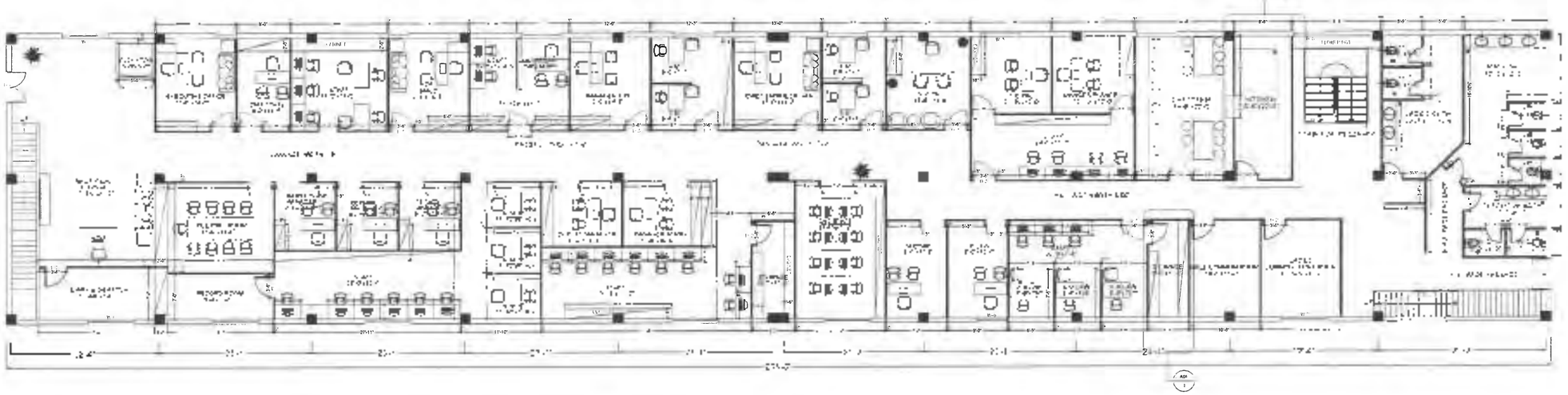
TITLE **HEAD OFFICE LAYOUT PLAN**	PRINCIPAL ARCHITECT	REVISION			SCALE	DRAWN BY	DESIGNED	N	J & M ASSOCIATES
DESIGN FOR PIDMEC	PROJECT ARCHITECT	NO.	DATE	REMARKS	1/16"=1'-0"	FAHAD-UR-REHMAN	RAFAQAT		ARCHITECTS & ENGINEERS
DISTRICT LAHORE	ASSISTANT ARCHITECT				DATE APRIL 2021	SHEET NO A-01	CHECKED		OFFICE NO 365-E M.A JOHER TOWN LAHORE

SCHEDULE OF DOORS

S.NO	TYPE	SIZE	REMARKS
01	D-1	5'-0"x7'-0"	GLASS DOOR
02	D-2	3'-6"x7'-0"	WOODEN DOOR
03	D-3	3'-6"x7'-0"	GLASS DOOR
04	D-4	3'-0"x7'-0"	WOODEN DOOR
05	D-5	3'-0"x7'-0"	GLASS DOOR
06	D-6	2'-6"x7'-0"	WOODEN DOOR

SCHEDULE OF WINDOWS

07	W-1	7'-0"x7'-0"	3'-0"	ALUMINUM WINDOW
08	W-2	5'-0"x3'-0"	3'-0"	ALUMINUM WINDOW
09	W-3	6'-0"x7'-0"	3'-0"	ALUMINUM WINDOW
10	W-4	6'-0"x3'-0"	3'-0"	ALUMINUM WINDOW
11	W-5	4'-0"x3'-0"	3'-0"	ALUMINUM WINDOW
12	W-6	4'-6"x7'-0"	3'-0"	ALUMINUM WINDOW
13	W-7	3'-0"x7'-0"	3'-0"	ALUMINUM WINDOW
14	W-8	2'-6"x1'-6"	3'-0"	ALUMINUM WINDOW



J & M Associates
365-E, Johar Town
Lahore-Pakistan
Mobile #: 0346-4666555
Mobile #: 0346-4050355

TITLE: GROUND FLOOR LAYOUT PLAN

DESIGN FOR PIOMEC

DISTRICT LAHORE

ARCHITECTURAL ARCHITECT

PROJECT ENGINEER

STRUCTURAL ENGINEER

S.NO	DATE	REMARKS

SCALE: 1/8"=1'-0"

DATE: APRIL 2025

DRAWING NO: REVISION AND

SHEET NO:

CHECK BY:

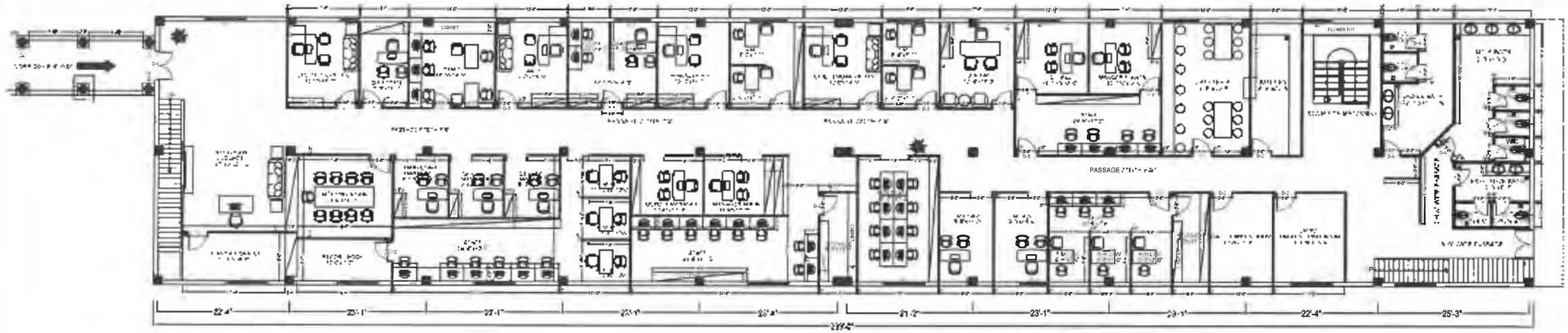
J & M ASSOCIATES
ARCHITECTS & ENGINEERS
OFFICE NO 365-E
JOHAR TOWN
LAHORE

SCHEDULE OF DOORS

S.NO	TYPE	SIZE	S.LE. FROM F.F	REMARKS
01	D-1	5'-0"x7'-0"		GLASS MAIN DOOR
02	D-2	3'-6"x7'-0"		WOODEN DOOR
03	D-3	3'-6"x7'-0"		GLASS DOOR
04	D-4	3'-0"x7'-0"		WOODEN DOOR
05	D-5	3'-0"x7'-0"		GLASS DOOR
06	D-6	2'-6"x7'-0"		WOODEN DOOR

SCHEDULE OF WINDOWS

07	W-1	7'-0"x7'-0"	3'-0"	ALUMINUM WINDOW
08	W-2	7'-0"x3'-0"	3'-0"	ALUMINUM WINDOW
09	W-3	6'-0"x7'-0"	3'-0"	ALUMINUM WINDOW
10	W-4	6'-0"x3'-0"	3'-0"	ALUMINUM GLASS WINDOW DOOR
11	W-5	4'-0"x3'-0"	3'-0"	ALUMINUM WINDOW
12	W-6	4'-6"x7'-0"	3'-0"	ALUMINUM WINDOW
13	W-7	3'-0"x7'-0"	3'-0"	ALUMINUM WINDOW
14	W-8	2'-6"x1'-6"	3'-0"	ALUMINUM WINDOW



J & M ASSOCIATES
ARCHITECTS & ENGINEERS
Office No 365-E
M.A Jouher Town
Lahore
Mobile: 0300-4050555
Mobile: 0321-4050555

LEGEND

- LOW HEIGHT DRY WALL PARTITION
- FULL HEIGHT DRY WALL PARTITION
- BRICK MASONRY WALL

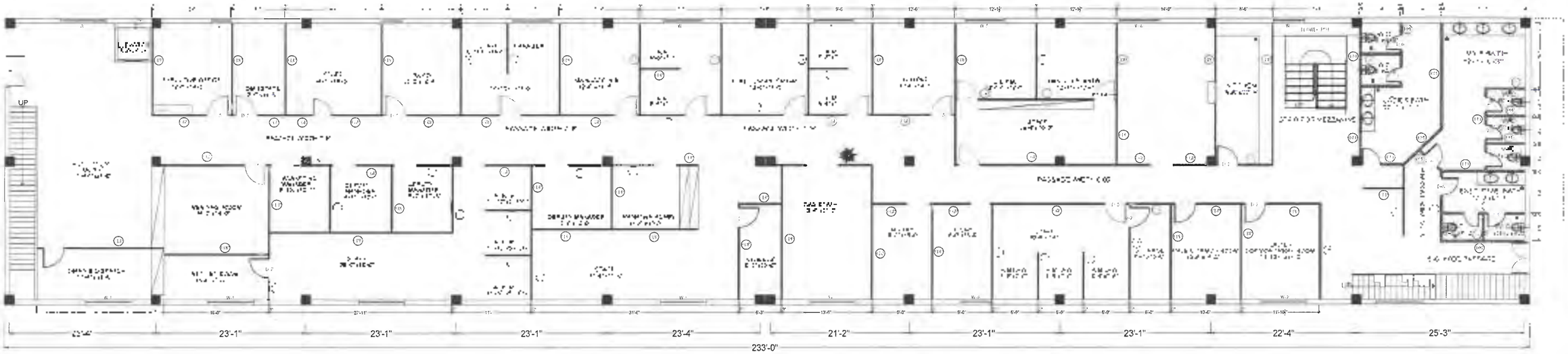
TITLE: GROUND FLOOR LAYOUT PLAN	PRINCIPAL ARCHITECT	REVISION			SCALE: 1/8"=1'-0"	DRAWING NO: P.K HOUSE-ARC	DRAWN BY: RAFAQAT	N	J & M ASSOCIATES ARCHITECTS & ENGINEERS OFFICE NO 365 - E M.A JOUHER TOWN LAHORE
DESIGN FOR PIDMEC	PROJECT ARCHITECT	S.NO	DATE	REMARKS					
DISTRICT LAHORE	ASSISTANT ARCHITECT				DATE: APRIL, 2021	SHEET NO: A-02	CHECKED		

SCHEDULE OF DOORS

SYMBOL NO	TYPE	SIZE	SILL LEVEL	REMARKS
D1	D-1	5'-0"x7'-0"		GLASS DOOR
D2	D-2	3'-6"x7'-0"		WOODEN DOOR
D3	D-3	3'-6"x7'-0"		GLASS DOOR
D4	D-4	3'-0"x7'-0"		WOODEN DOOR
D5	D-5	3'-0"x7'-0"		GLASS DOOR
D6	D-6	2'-6"x7'-0"		WOODEN DOOR

SCHEDULE OF WINDOWS

07	W-1	7'-0"x7'-0"	3'-0"	ALUMINUM WINDOW
08	W-2	7'-0"x5'-0"	3'-0"	ALUMINUM WINDOW
09	W-3	6'-0"x7'-0"	3'-0"	ALUMINUM WINDOW
10	W-4	5'-3"x3'-0"	3'-0"	ALUMINUM WINDOW
11	W-5	4'-9"x3'-0"	3'-0"	ALUMINUM WINDOW
12	W-6	4'-6"x7'-0"	3'-0"	ALUMINUM WINDOW
13	W-7	3'-0"x7'-0"	3'-0"	ALUMINUM WINDOW
14	W-8	2'-6"x1'-6"	3'-0"	ALUMINUM WINDOW

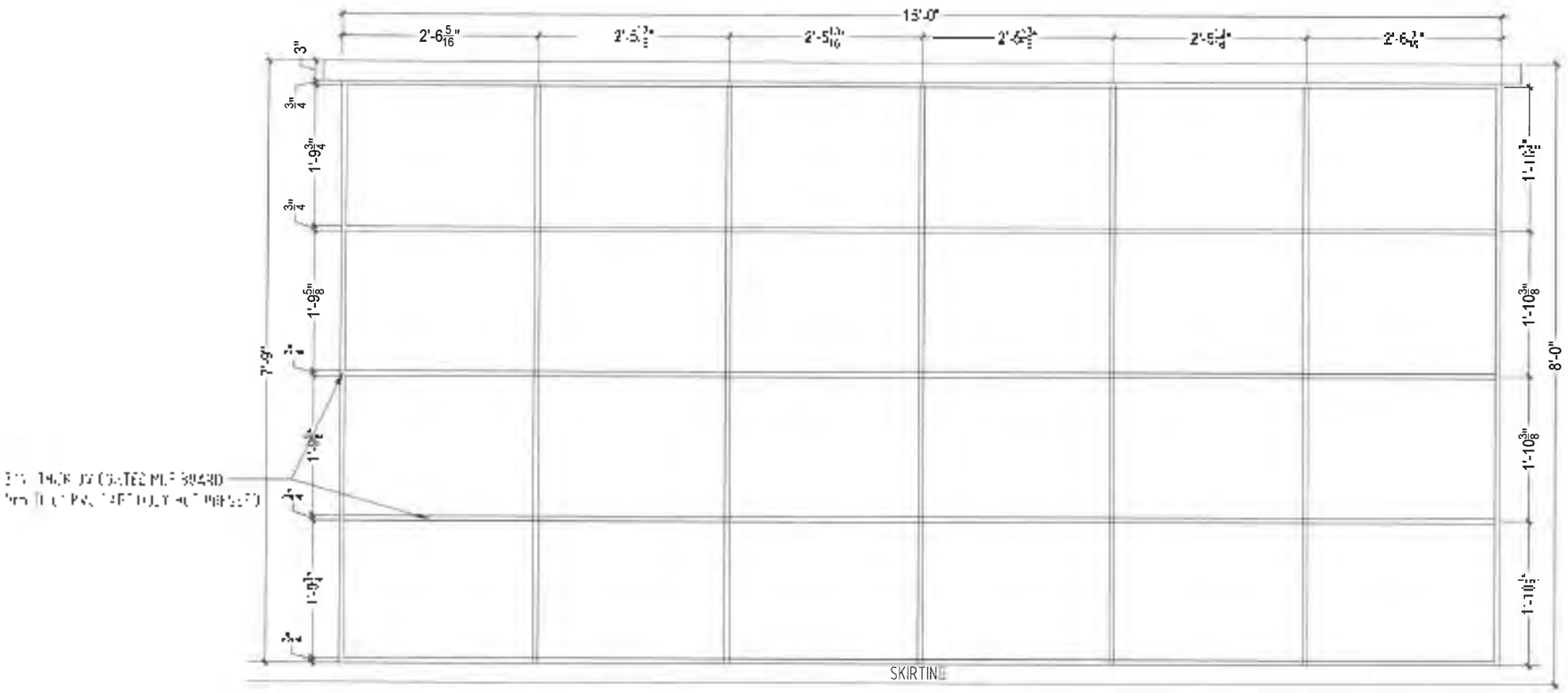


LEGEND

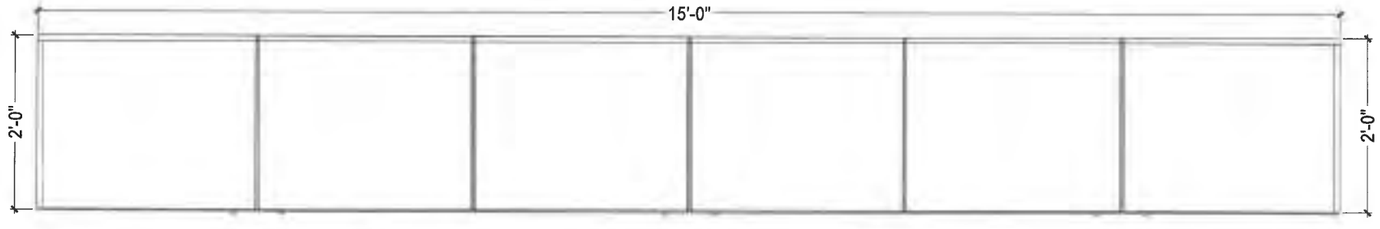
- LOW HEIGHT DRY WALL PARTITION (DP)
- FULL HEIGHT DRY WALL PARTITION (DP)
- FULL HEIGHT GLASS PARTITION (GP)
- BRICK MASONRY WALL (BW)

J & M Associates
365-E, Johar Town
Lahore-Pakistan
Mobile #: 0300-4[illegible]
Mobile #: 92-42-3[illegible]

TITLE: GROUND FLOOR PARTITION WALL PLAN	PROJECT ARCHITECT	REVISION		SCALE: 1/8"=1'-0"	DRAWING BY: REV. HOUSHARD	DRAWN BY: RAFAQAT	J & M ASSOCIATES ARCHITECTS & ENGINEERS OFFICE NO.365 - E JOHAR TOWN LAHORE
DESIGN FOR: PIDMEC	PROJECT ARCHITECT	SIGN	DATE	REMARKS	DATE: APRIL 2025	SHEET NO: A-03	CHECKED BY
DISTRICT LAHORE	ASSISTANT ARCHITECT						



TYP. CABINET ELEVATION



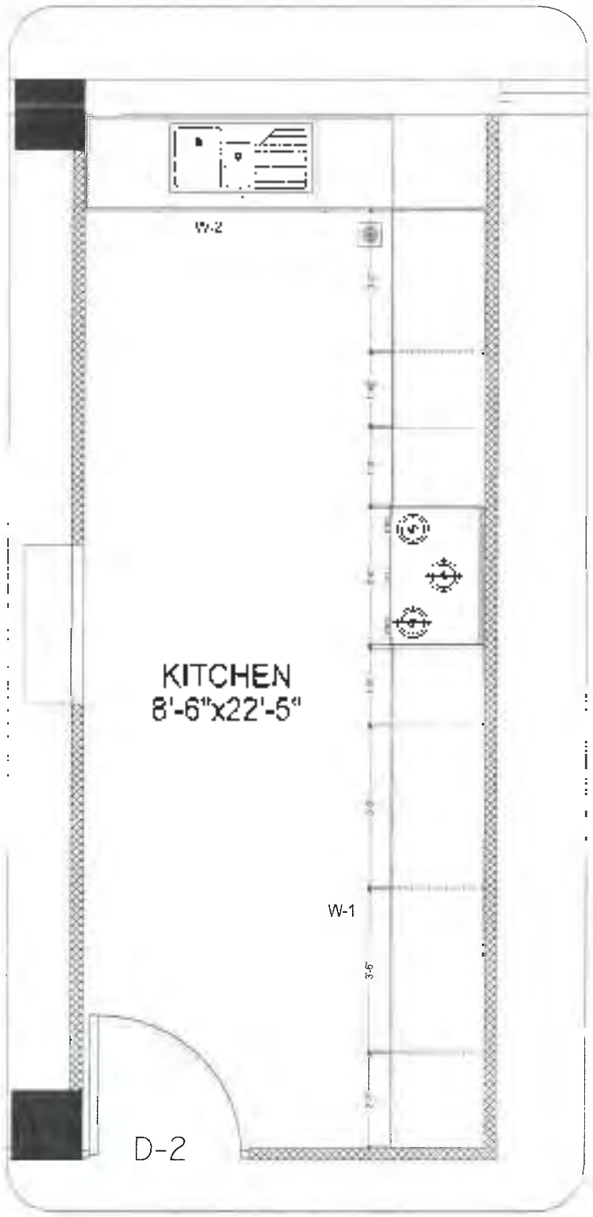
TYP. CABINET TOP VIEW

J & M Associates
365-E, Johar Town
Lahore, Pakistan
Mobile #: 0345-8[illegible]
Mobile #: 0345-8[illegible]

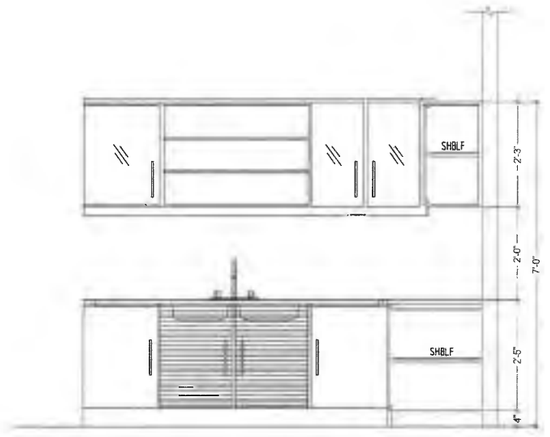
TITLE: STORAGE CABINATE TYPICAL LAYOUT	PRINCIPAL ARCHITECT	REVISION			SCALE: 1/8"=1'-0"	DRAWING No: REV-HO/34-ARC	DRAWN BY: RAFAQAT
DESIGN FOR PIDMEC	PROJECT ARCHITECT	S.NO	DATE	REMARKS	DATE: APRIL 2025	SHEET No: A-04	CHECKED BY:
DISTRICT LAHORE	ASSISTANT ARCHITECT						

N

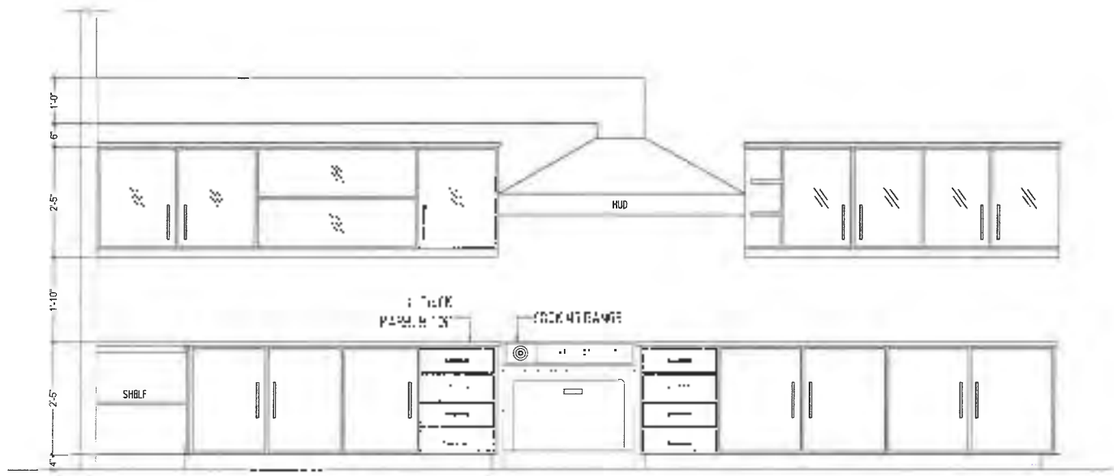
J & M ASSOCIATES
ARCHITECTS & ENGINEERS
OFFICE NO 365 - E
M A JOHER TOWN
LAHORE



PLAN



WALL 2 ELEVATION



WALL 1 ELEVATION

J & M Associates
365-E, J[illegible]
Lahore [illegible]
Mobile # [illegible]
Mobile [illegible]

KITCHEN CABINATE TYPICAL LAYOUT

DESIGN FOR PIDMEC

DISTRICT LAHORE

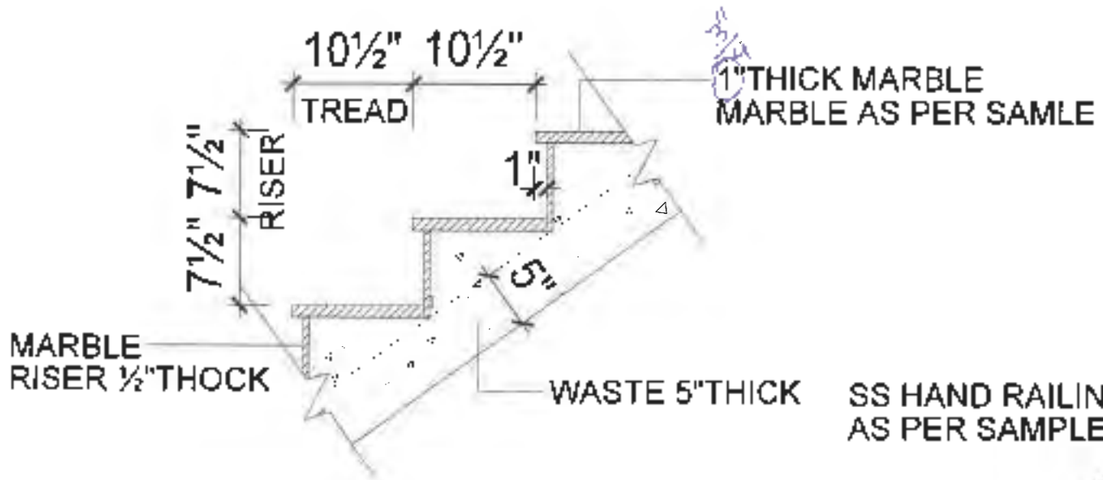
PRINCIPAL ARCHITECT
PROJECT ARCHITECT
ASSISTANT ARCHITECT

SR.#	DATE	REVISION REMARKS

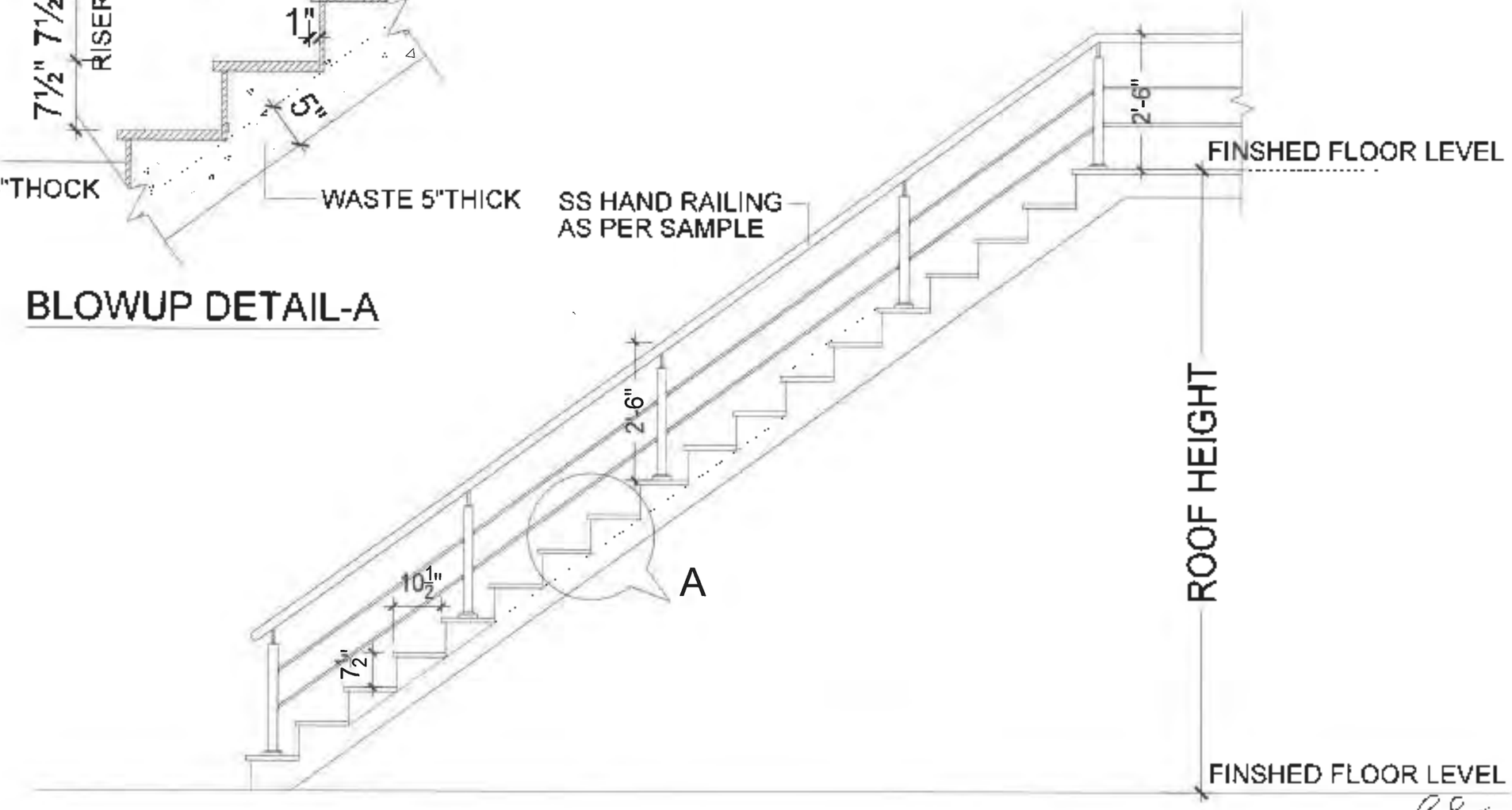
SCALE 1/8" = 1'-0"
DRAWN BY REV. NO.04-ARC RAFAQAT
DATE APRIL 2025 CHECKED BY
SHEET NO. A-04.1

N

J & M ASSOCIATES
ARCHITECTS & ENGINEERS
OFFICE NO.365 - E
M.A. JOHAR TOWN
LAHORE



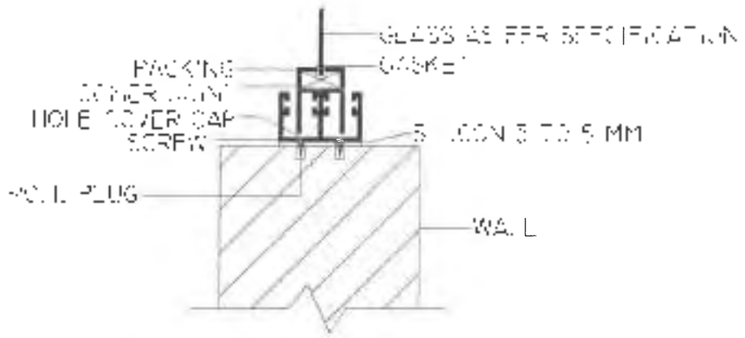
BLOWUP DETAIL-A



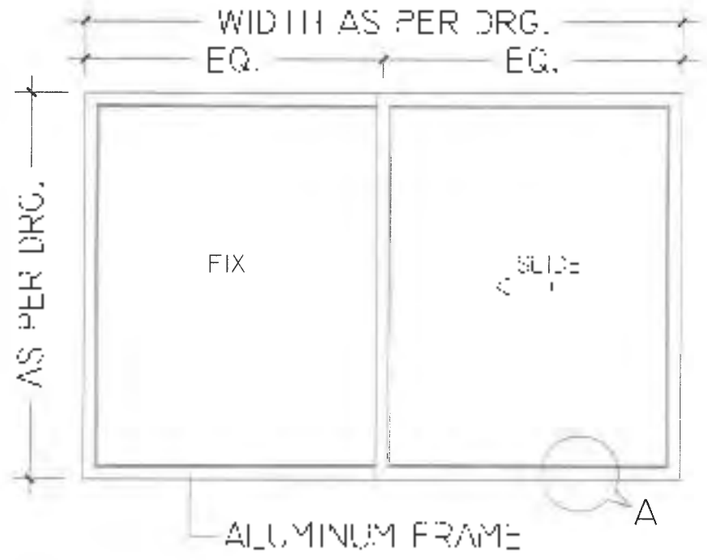
TYPICAL STAIR DETAIL

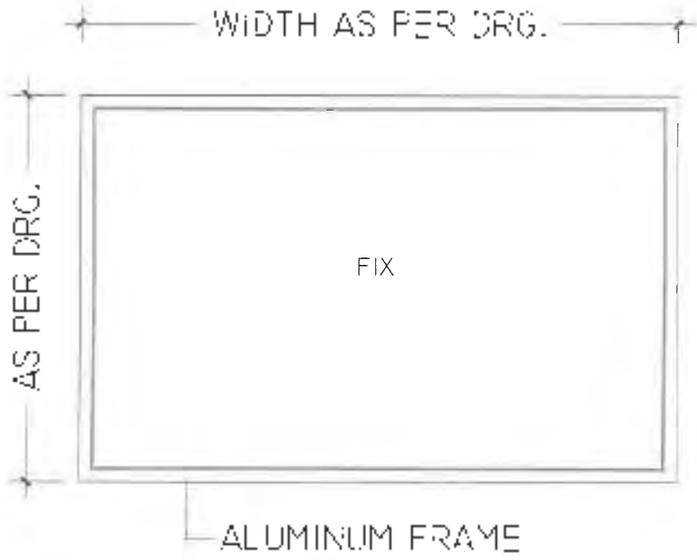
J & M Associates
365-E, Johar Town
Lahore-Pakistan
Mobile #: 0346-4666555
Mobile #: 0346-4050555

TITLE: TYP. STAIRS DETAIL	PRINCIPAL ARCHITECT	REVISION: SNO / DATE / REMARKS	SCALE: 1/8"=1'-0"	DRAWING No: EA-HOMES-ARC	DRAWN BY: RAI-AUAI	J & M ASSOCIATES ARCHITECTS & ENGINEERS OFFICE NO 365 - E M.A JOHER TOWN LAHORE
DESIGN FOR PIDMEC	PROJECT ARCHITECT		DATE: APRIL 2025	SHEET No: A 05	CHECK BY	
DISTRICT LAHORE	ASSISTANT ARCHITECT					



SECTIONAL DETAIL-A
ALUMINUM SINGLE TRACK SLIDING WINDOWS
SINGLE GLAZED WITHOUT WIREMESH

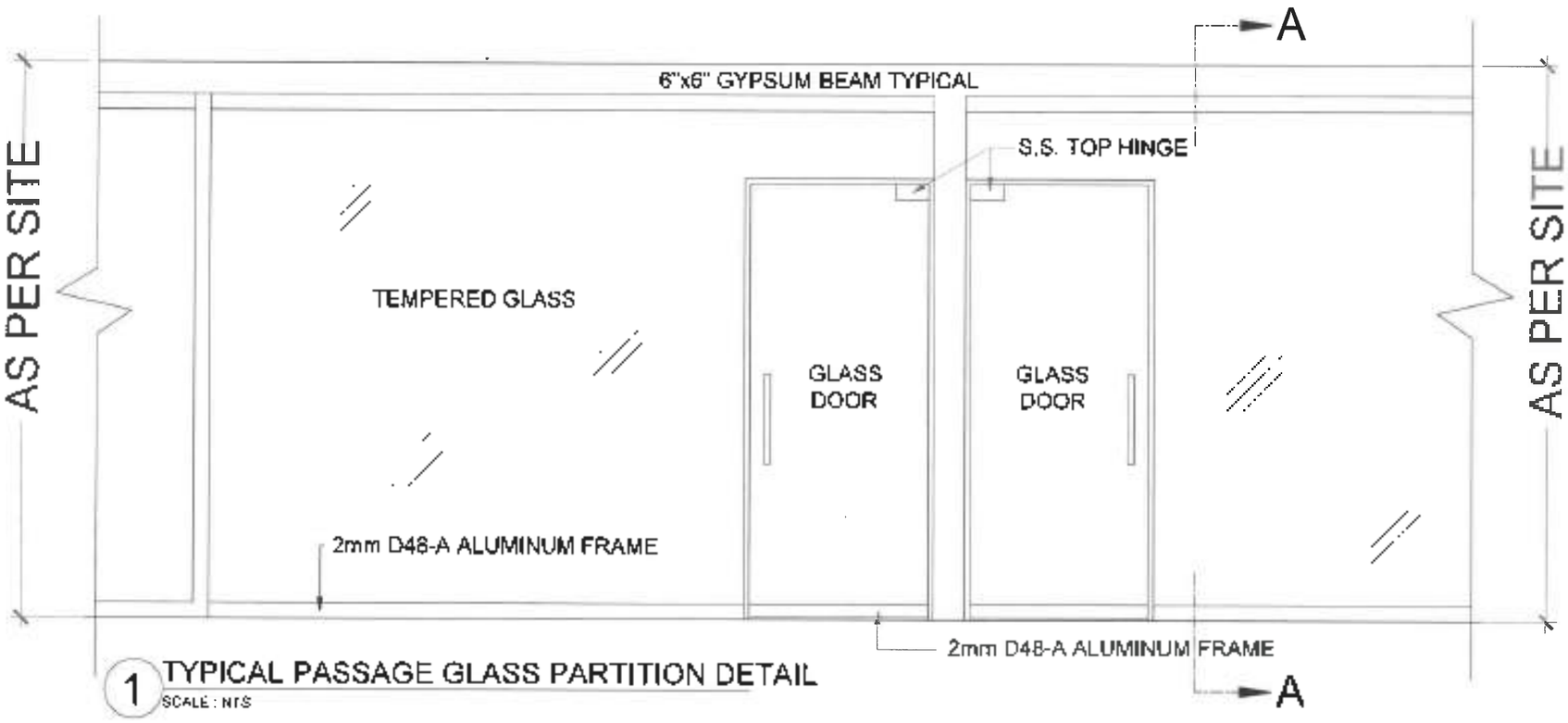




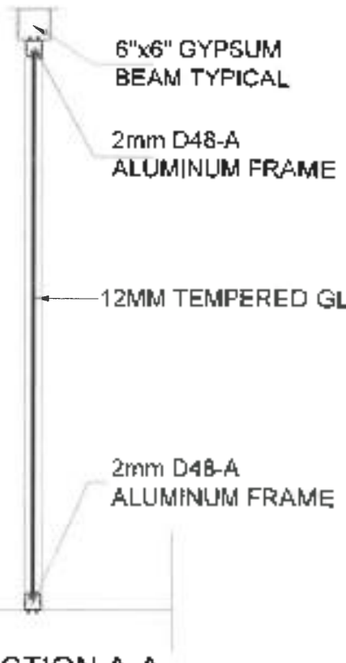
J & M Associates
365-E, Johar Town
Lahore-[illegible]
Mobile #: [illegible]
Mobile #: [illegible]

TITLE: TYPICAL WINDOWS DETAIL	PROJECT ARCHITECT:	REVISION			SCALE: 1"=1'-0"	DRAWING No: REV-WOBARC	DRAWN BY: RAFAQAT
DESIGN FOR: PIDMEC	PROJECT ENGINEER:	S.NO.	DATE	REMARKS	DATE: APRIL 2025	SHEET No: 0.00	CHECKED:
DISTRICT: LAHORE	STRUCTURAL ENGINEER:						

J & M ASSOCIATES
ARCHITECTS & ENGINEERS
OFFICE NO 365-E
MAJU TOWN
LAHORE



1 TYPICAL PASSAGE GLASS PARTITION DETAIL
SCALE : NTS

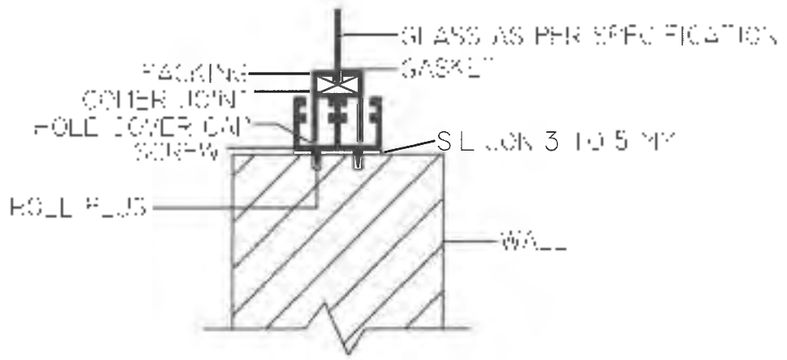


1 SECTION A-A
SCALE : NTS

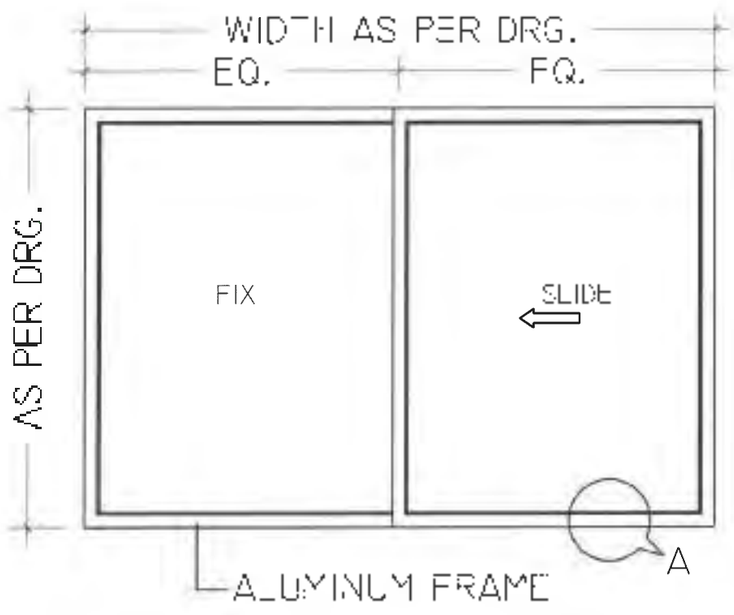
J & M Associates
365-E, Johar Town
Lahore-Pakistan
Mobile #: 0346-4666551
Mobile #: 0346-4050555

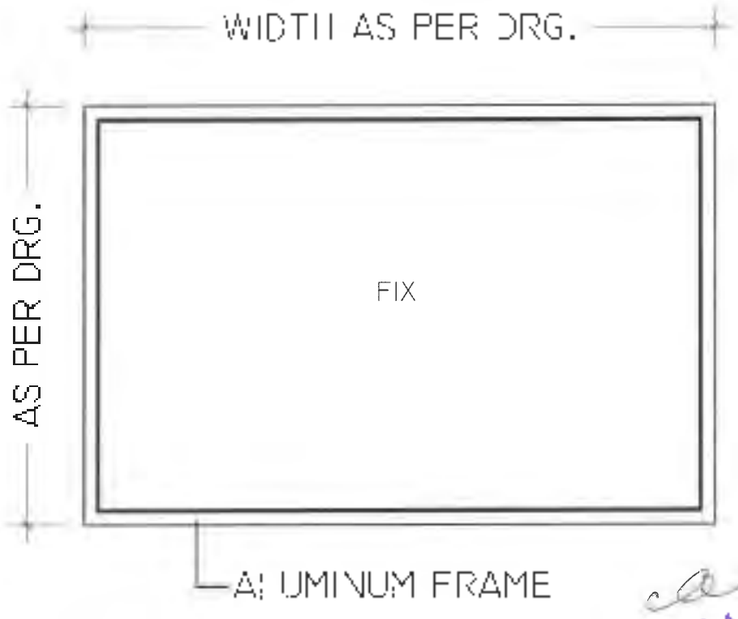
TITLE: GROUND FLOOR PASSAGE GLASS PARTITION DETAIL	PRINCIPAL ARCHITECT	REVISION			SCALE: 1/8"=1'-0"	DRAWING No: FR-HOJAK-1-ARC	DRAWN BY: RAFAQAT
DESIGN FOR PIDMEC	PROJECT ARCHITECT	S.NO	DATE	REMARKS	DATE: APRIL 2025	SHEET No: A 08.1	CHECK BY
DISTRICT LAHORE	ASSISTANT ARCHITECT						

J & M ASSOCIATES
ARCHITECTS & ENGINEERS
OFFICE NO 365 - E
M.A JOHER TOWN
LAHORE



SECTIONAL DETAIL A
A JAMB JAMB SINGLE TRACK SLIDING WINDOWS
SINGLE GLAZED WITH OUT MESH



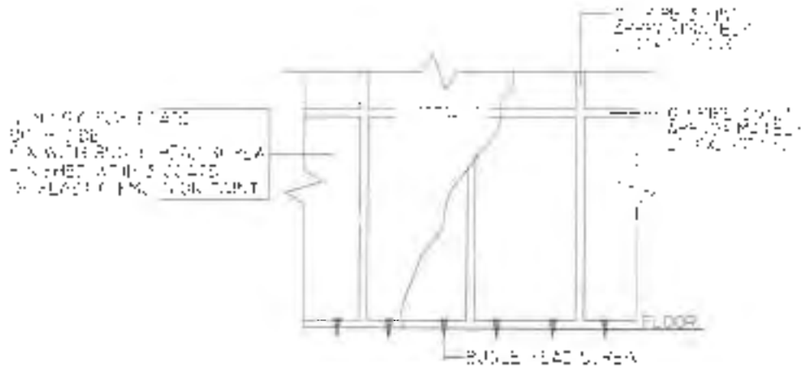


J & M Associates
365-E, Johar Town
Lahore-Pakistan
Mobile #: 0[illegible]-4566555
Mobile #: 0[illegible]-4050555

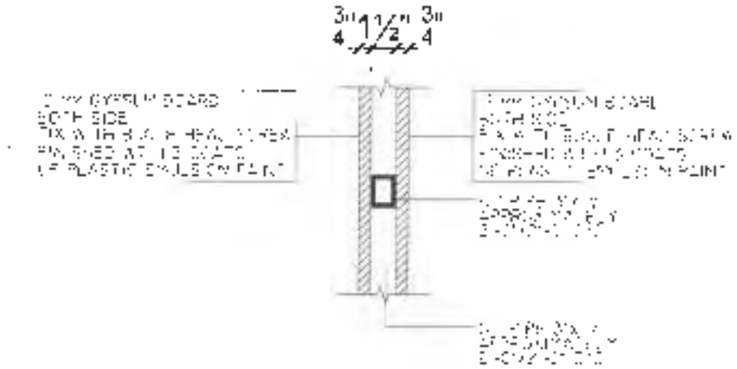
TITLE: TYPICAL WINDOWS DETAIL	PRINCIPAL ARCHITECT	REVISION			SCALE	DRAWING No.	DRAWN BY
DESIGN FOR PIDMEC	PROJECT ARCHITECT	S.NO	DATE	REMARKS		EX.-1009 ARC	RAFAQAT
DISTRICT LAHORE	ASSISTANT ARCHITECT				DATE: APRIL 2021	SHEET No: A 08	CHECK BY

N

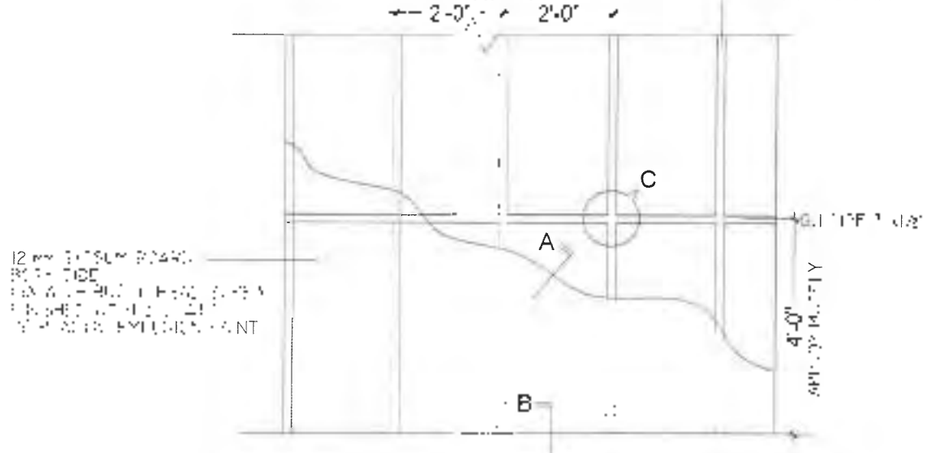
J & M ASSOCIATES
ARCHITECTS & ENGINEERS
OFFICE NO.365 - E
M A JOHER TOWN
LAHORE



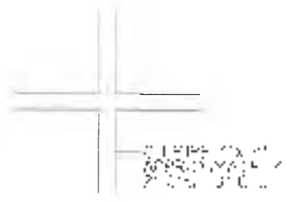
DETAIL-B



DETAIL-A



PARTITION DETAIL

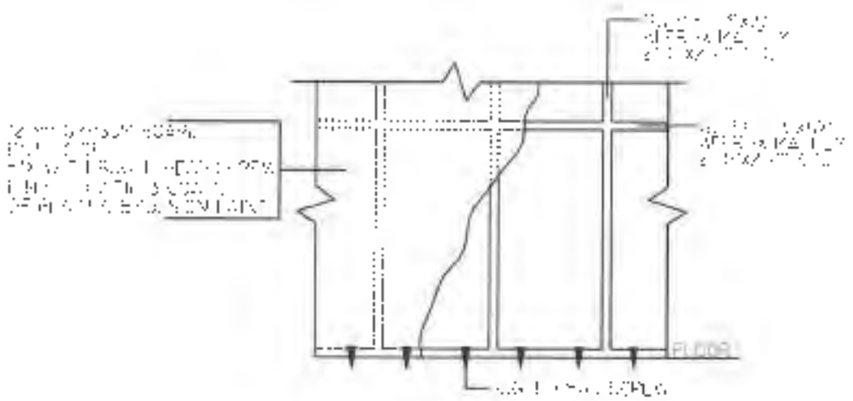


DETAIL-C

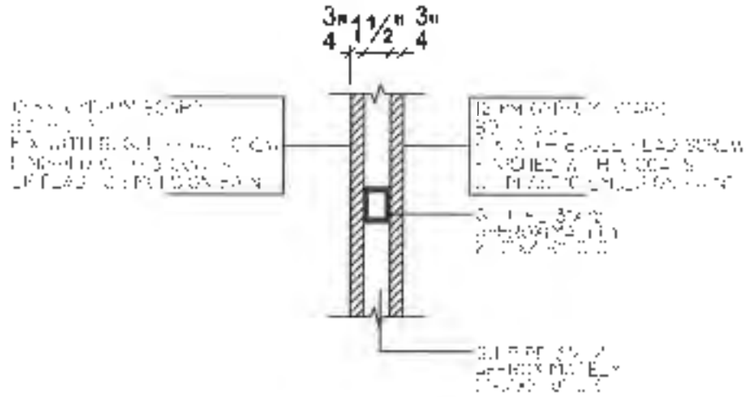
J & M Associates
365-E, Johar Town
Lahore-Pakistan
Mobile #
Mobile #

TITLE: GYPSUM PARTITIONS DETAIL	PRINCIPAL ARCHITECT	REVISION	SCALE	DRAWN	TRACED
DESIGN FOR PDMEC	REVIEWED / APPROVED	NO. DATE REMARKS		CHECKED	SUBMITTED
DISTRICT LAHORE	ASSISTANT ARCHITECT		DATE APRIL 2025	SHEET NO. A-9	DRAWING NO.

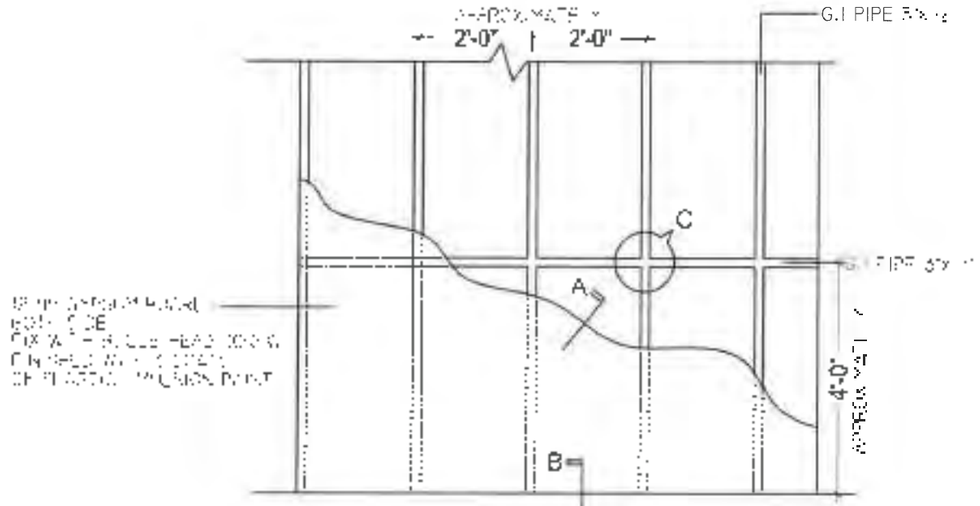
J & M ASSOCIATES
ARCHITECTS & ENGINEERS
OFFICE NO 365-E
MANCHESTER ROAD
LAHORE



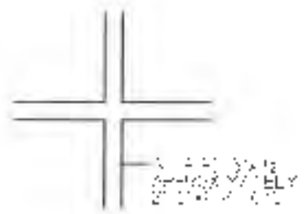
DETAIL-B



DETAIL-A



PARTITION DETAIL

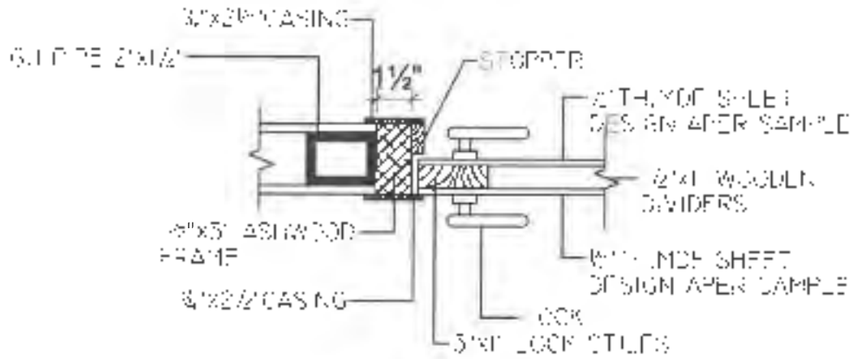


DETAIL-C

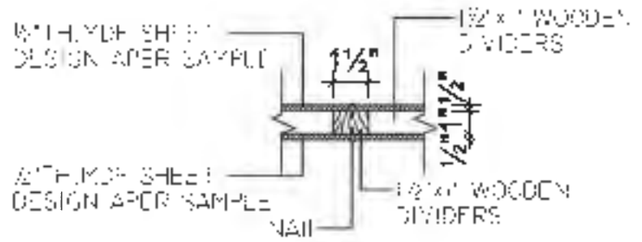
J & M Associates
365-E, Johar Town
Lahore, Pakistan
Mobile #: 0346-4666555
Mobile #: 0346-4050555

TITLE: GYPSUM PARTITIONS DETAIL	PROJECT:	REVISION			SCALE: 3/4"=1'-0"	DRAWING No: EX HO/04/ARC	DRAWN BY: RAFAQAT	N
DESIGN FOR PIDMEC	PROJECT ARCHITECT:	NO.	DATE	REMARKS	DATE: APRIL 2025	SHEET No: A-9	CHECKED BY:	
DISTRICT LAHORE	ASSISTANT ARCHITECT:							

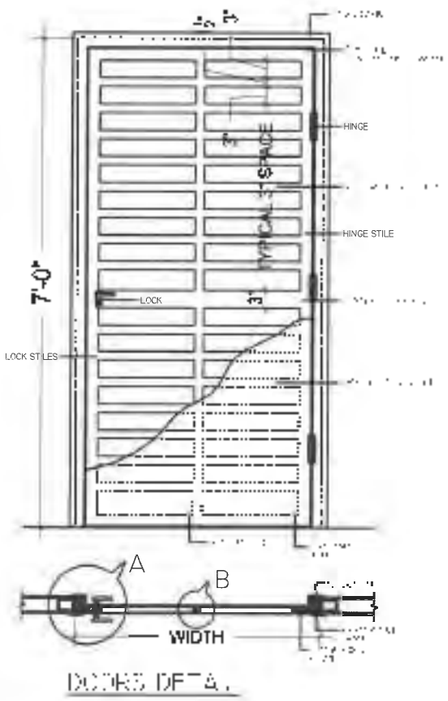
J & M ASSOCIATES
ARCHITECTS & ENGINEERS
OFFICE NO.365 - E
M A JOHER TOWN
LAHORE



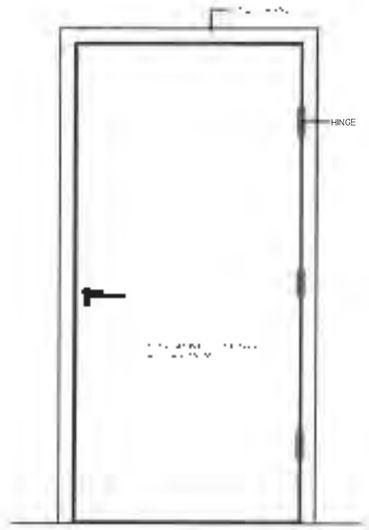
DETAIL-A



DETAIL-B

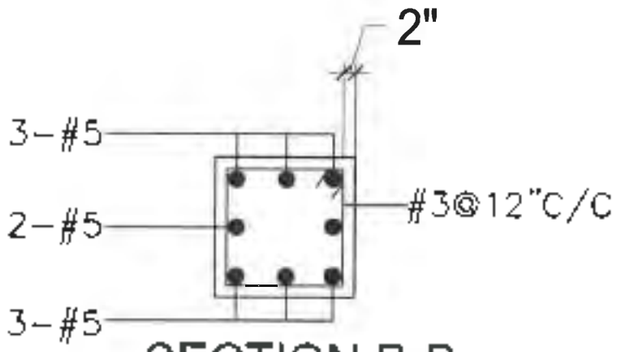


DOORS DETAIL

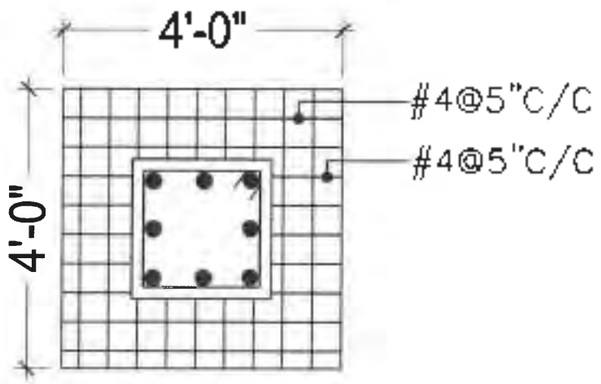


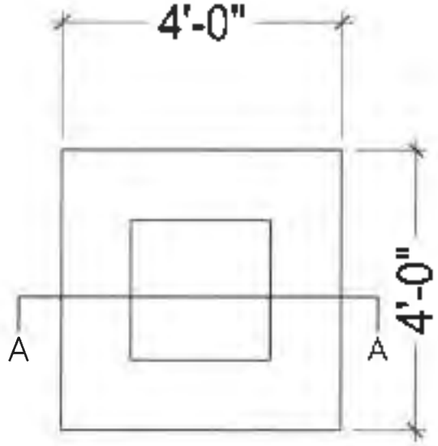
J & M Associates
365-E, Johar Town
Lahore-Pakistan
Mobile: 0300-4050555

TITLE: TYPICAL DOOR DETAIL	PRINCIPAL ARCHITECT	REVISION			SCALE: 1"=1'-0"	DRAWING: EXHIBITION-ARC	DRAWN BY: RAFAQAT	N	J & M ASSOCIATES ARCHITECTS & ENGINEERS OFFICE NO 365 - E M A JOHER TOWN LAHORE
DESIGN FOR PIDMC	PROJECT ARCHITECT	S.NO	DATE	REMARKS	DATE: APRIL 2021	SHEET NO: A 10	CHECK BY		
DISTRICT LAHORE	ASSOCIATE ARCHITECT								

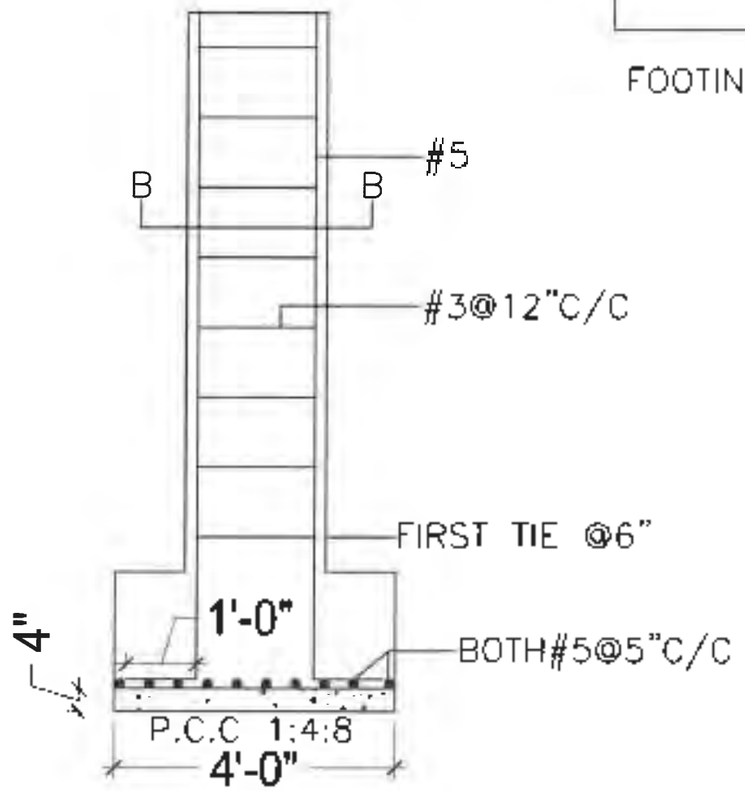


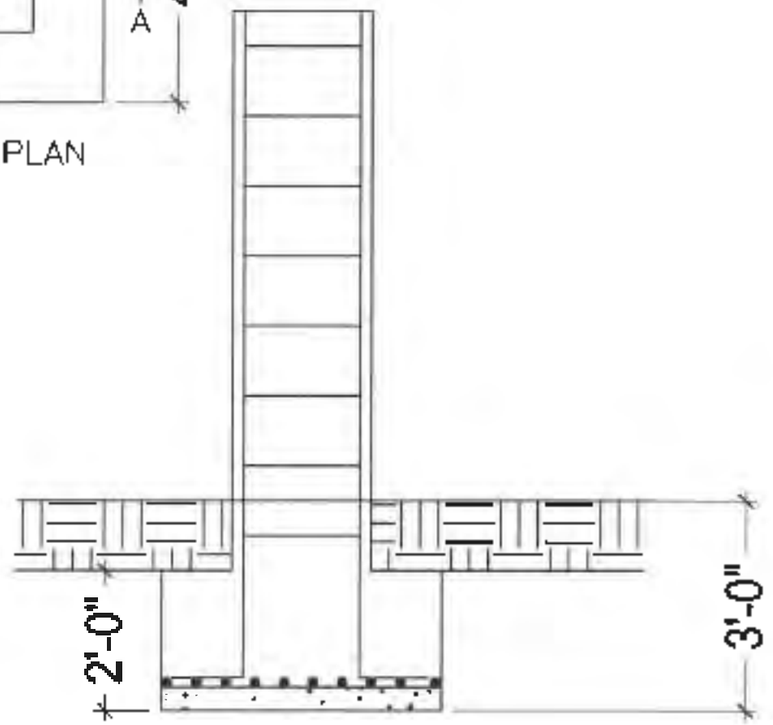
SECTION B-B





FOOTING PLAN

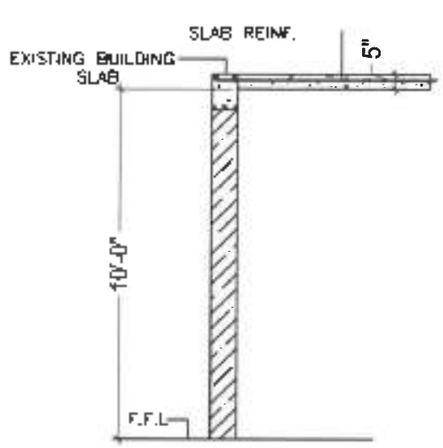




SECTION A-A

J & M Associates
365-E, Johar Town
Lahore-Pakistan
Mobile #: 0346-4665555
Mobile #: 0346-4050555

TITLE: CORRIDOR REINFORCEMENT DETAIL	PRINCIPAL ARCHITECT	REVISION			SCALE	DRAWING No.	DRAWN BY	J & M ASSOCIATES
DESIGN FOR PIDMCD	PROJECT ARCHITECT	NO.	DATE	REMARKS		EXHOUSE-ARC	RAFAQAT	ARCHITECTS & ENGINEERS
DISTRICT LAHORE	ASSISTANT ARCHITECT				DATE APRIL 2025	SHEET No. A 11	CHECKED BY	OFF OF NO 365 - E M A JOHER TOWN LAHORE



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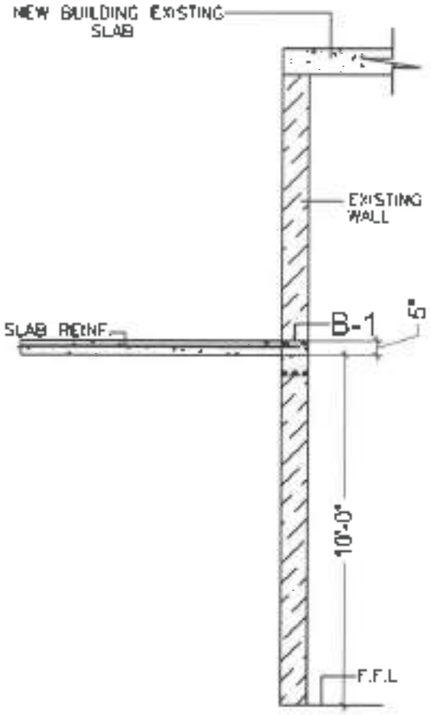
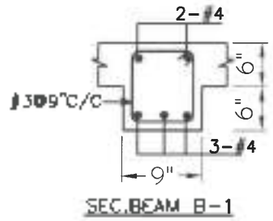
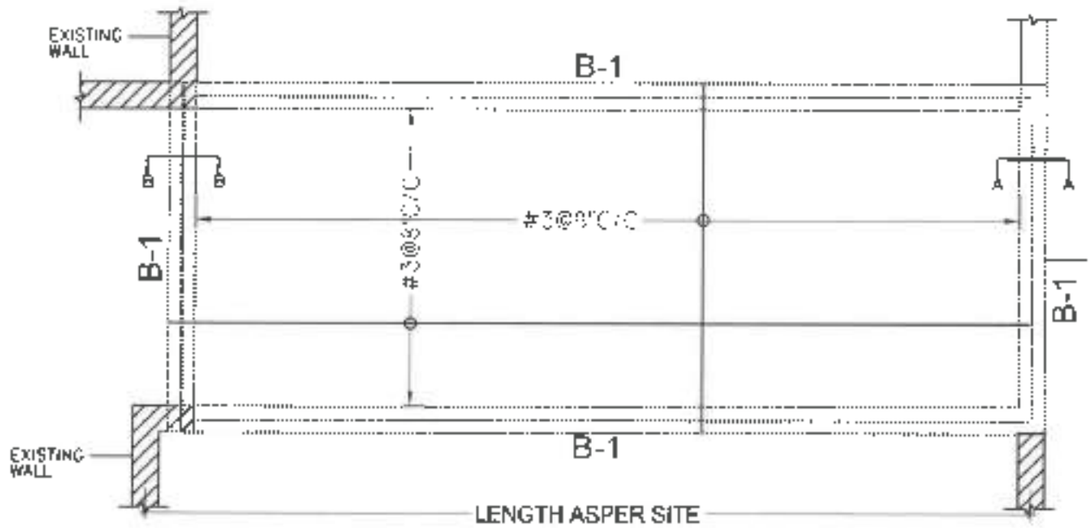


SECTION A-A



SEC.BEAM B-1

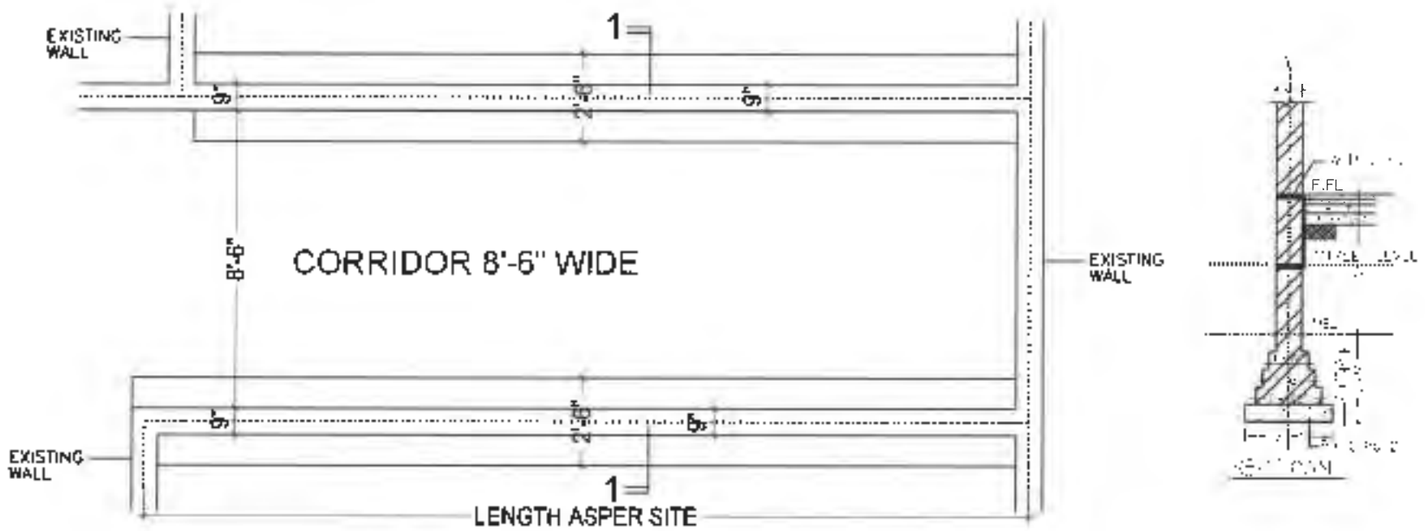


SLAB THICKNESS 5"

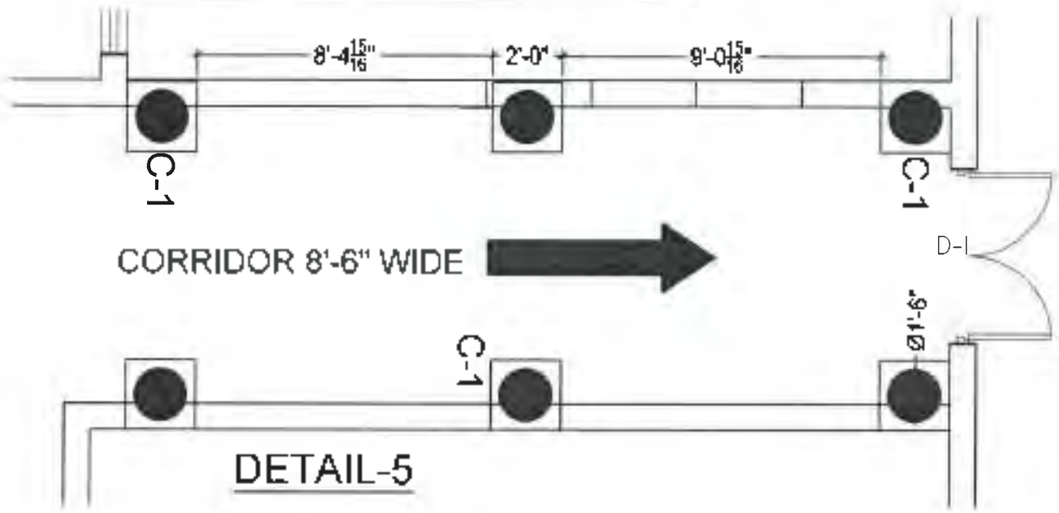
DETAIL-5 STRUCTURE PLAN

J & M Associates
365-E, Johar Town
Lahore
Mobile #
M.

TITLE: CORRIDOR REINFORCEMENT DETAIL	PRINCIPAL ARCHITECT	REVISION			SCALE: 1/2"=1'-0"	DRAWING NO: EX HDIB-ARC	DRAWN BY: RAFAQAT	N	J & M ASSOCIATES ARCHITECTS & ENGINEERS OFFICE NO 365 - E M A JOHER TOWN LAHORE
DESIGN FOR PIDMEC	PROJECT ARCHITECT	NO.	DATE	REMARKS	DATE: APRIL 2020	SHEET No. A 15	CHECKED BY		
DISTRICT LAHORE	ASSISTANT ARCHITEC								



DETAIL-5 FOUNDATION PLAN



DETAIL-5

J & M Associates
365-B, Johar Town
Lahore
Mobile #: 0346-4050555

TITLE: CORRIDOR PLAN &FOUNDATION DETAIL-5	PRINCIPAL ARCHITECT	REVISION			SCALE: 3/4"=1'-0"	DRAWING: EX HOUSE-ARC	DESIGN BY: RAFAQAT	N	J & M ASSOCIATES ARCHITECTS & ENGINEERS OFFICE NO.365 'B' MA JOHER TOWN LAHORE
DESIGN FOR: PIDMEC	PROJECT ARCHITECT	S.NO	DATE	REMARKS	DATE: APRIL 2025	SHEET No: A-17	CHECK BY:		
DISTRICT LAHORE	ASSISTANT ARCHITECT								

FLOORING DRAWINGS

PROJECT: EXTENSION OF PIEDMC HEAD OFFICE IN SUNDAR INDUSTRIAL ESTATE

CLIENT: PIEDMC

ADDRESS: SUNDAR INDUSTRIAL ESTATE LAHORE

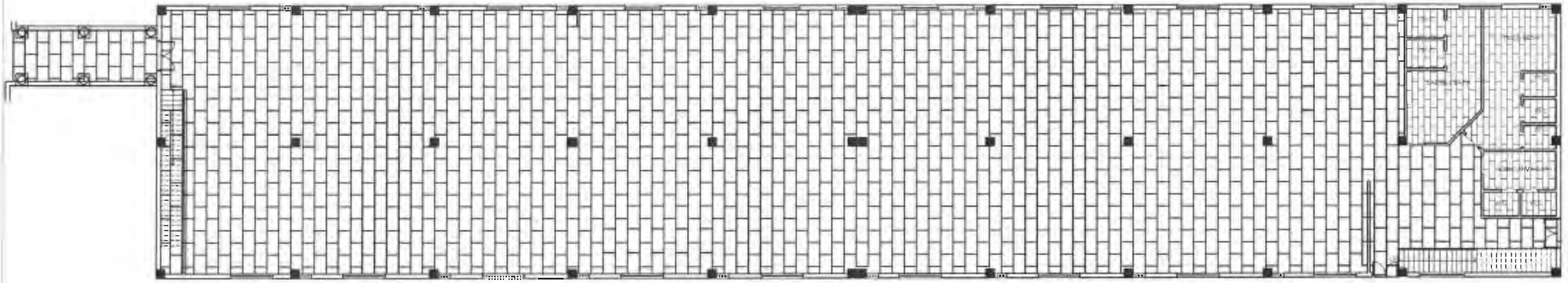
J & M ASSOCIATES

ADDRESS: OFFICE NO,365 E JOHAR LAHORE

EMAIL: jandmassociates.pk@gmail.com

CONTACT NO: +92-346-4666555

J & M Associates
365-E, Johar Town
Lahore-Pakistan
Mobile #: 0346-4666555
Mobile #: 0346-4050555



GROUND FLOOR TILE PLAN

J & M Associates
365-E, Johar Town
Lahore-Pakistan
Mobile #: 0346-4666555
Mobile #: 0346-4050555

TITLE **GROUND FLOOR FLOORING DETAIL**	PRINCIPAL ARCHITECT	REVISION			SCALE	DRAWING No	DRAWN BY	N
DESIGN FOR PIDMEC	PROJECT ARCHITECT	SR#	DATE	REMARKS	1/8" = 1'-0"	FX 40001-FLR	RAFAQAT	
D STRICT LAHORE	ASSISTANT ARCHITECT				DATE APRIL 2025	SHEET No F 01	CHECKED BY	

J & M ASSOCIATES
ARCHITECTS & ENGINEERS
OFFICE NO 365 - E
M.A JOHER TOWN
LAHORE

PLUMBING DRAWINGS

PROJECT: EXTENSION OF PIEDMC HEAD OFFICE IN SUNDAR INDUSTRIAL ESTATE

CLIENT: PIEDMC

ADDRESS: SUNDAR INDUSTRIAL ESTATE, LAHORE

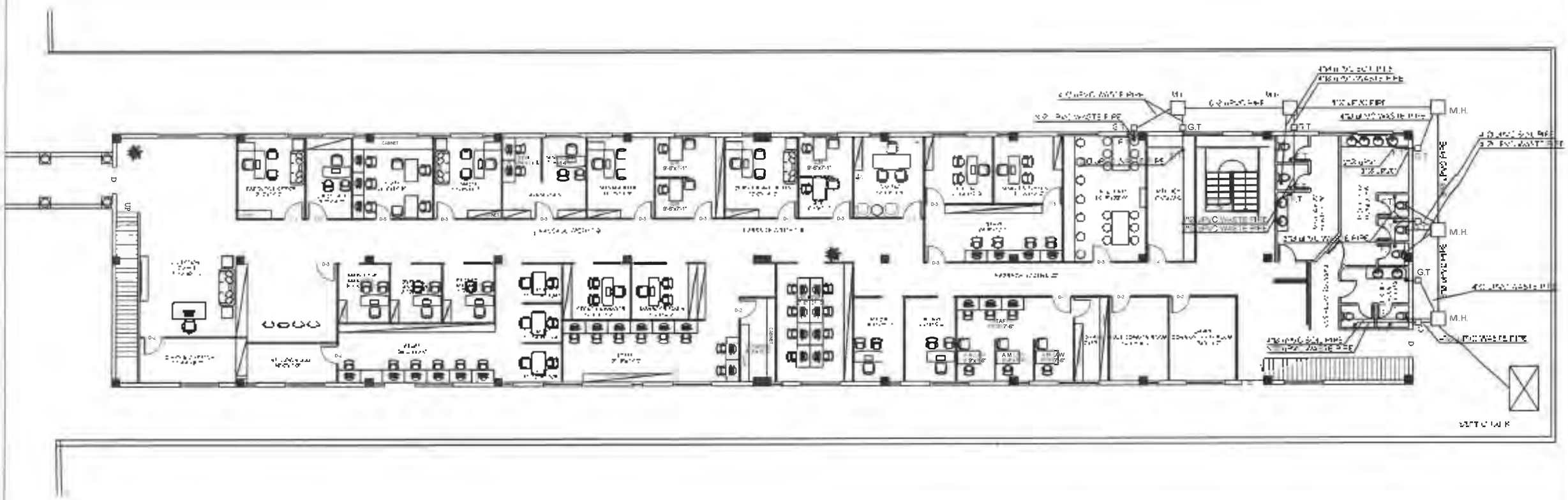
J & M ASSOCIATES

ADDRESS: OFFICE NO,365 E JOHAR LAHORE

EMAIL: jandmassociates.pk@gmail.com

CONTACT NO: +92-346-4666555

J & M Associates
365-E, Johar Town
Lahore
Mobile #: 0346-4666555
Mobile #: 0346-4050555

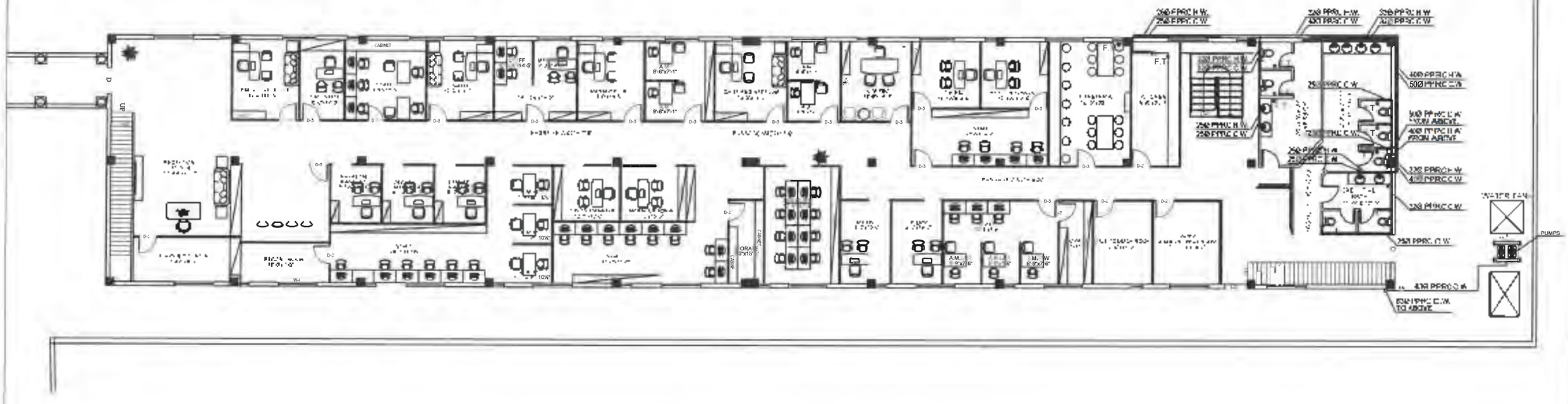


J & M Associates
365-E, Johar Town
Lahore-Pakistan
Mobile # 0346-4666555
Mobile # 0346-4050555

TITLE **GROUND FLOOR PLUMBING LAYOUT PLAN**	PROJECT ARCHITECT	REVISION			SCALE 1/8"=1'-0"	DRAWING No EX HOU2-PLUM	DRAWN BY RAFAQAT
DESIGN FOR PIDMEC		SR.NO	DATE	REMARKS	DATE APRIL 2025	SHEET No P.00	CHECK BY
DISTRICT LAHORE	ASSISTANT ARCHITECT						

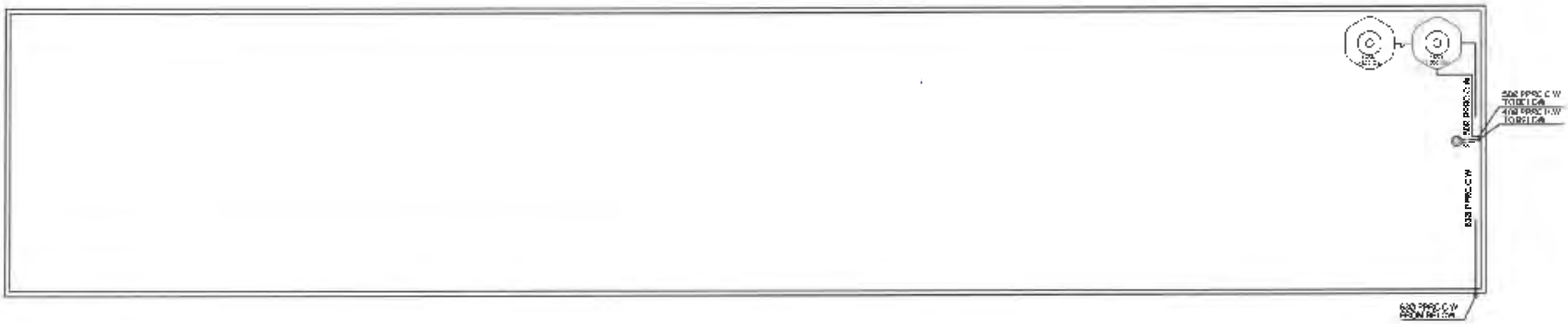
N

J & M ASSOCIATES
ARCHITECTS & ENGINEERS
OFFICE NO.365 - E
M.A. JOHER TOWN
LAHORE



J & M Associates
365-E, Johar Town
Lahore-[illegible]
Mobile #: [illegible]-4666555
Mobile #: 0346-4050555

TITLE: GROUND FLOOR DOMESTIC WATER LAYOUT PLAN	PRINCIPAL ARCHITECT	REVISION			SCALE: 1/8" = 1'-0"	DRAWING No: EX HO/03-PLUM	DRAWN BY: RAF&QAT	N	J & M ASSOCIATES ARCHITECTS & ENGINEERS OFFICE NO 365 - E M A JOHER TOWN LAHORE
DESIGN FOR PIDMEC	PROJECT ARCHITECT	S.NO	DATE	REMARKS					
DISTRICT LAHORE	ASSISTANT ARCHITECT				DATE: APRIL 2025	SHEET No: P 01	CHECKED		



J & M Associates
365-E, Johar Town
Lahore Pakistan
Mobile #: 0346-4666555
Mobile #: 0346-4050555

TITLE: **ROOF FLOOR PLUMBING LAYOUT PLAN**	PRINCIPAL ARCHITECT	REVISION			SCALE	DRAWING NO	DRAWN BY	N
DESIGN FOR PIDMEC	PROJECT ARCHITECT	NO	DATE	REMARKS	1/8" = 1'-0"	EX-110-04-PLM	RAFAQAT	
DISTRICT LAHORE	ASSISTANT ARCHITECT				DATE: APRIL 2015	SHEET NO: P-02	CHECKED	

J & M ASSOCIATES
ARCHITECTS & ENGINEERS
OFFICE NO 365 - E
M.A JOHER TOWN
LAHORE

ELECTRICAL DRAWINGS

PROJECT: EXTENSION OF PIEDMC HEAD OFFICE IN SUNDAR INDUSTRIAL ESTATE

CLIENT: PIEDMC

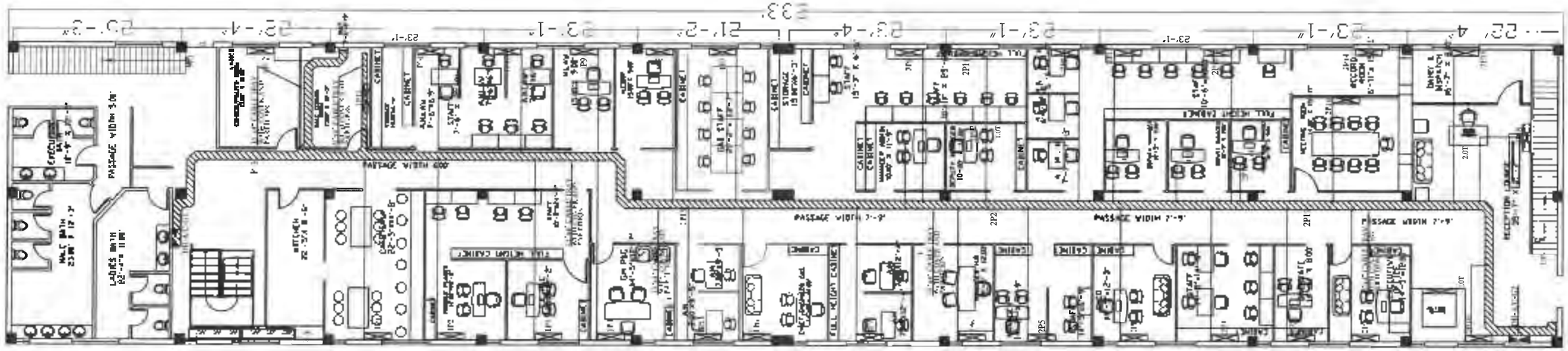
ADDRESS: SUNDAR INDUSTRIAL ESTATE, LAHORE

J & M ASSOCIATES

ADDRESS: OFFICE NO,365 E JOHAR LAHORE

EMAIL: jandmassociates.pk@gmail.com

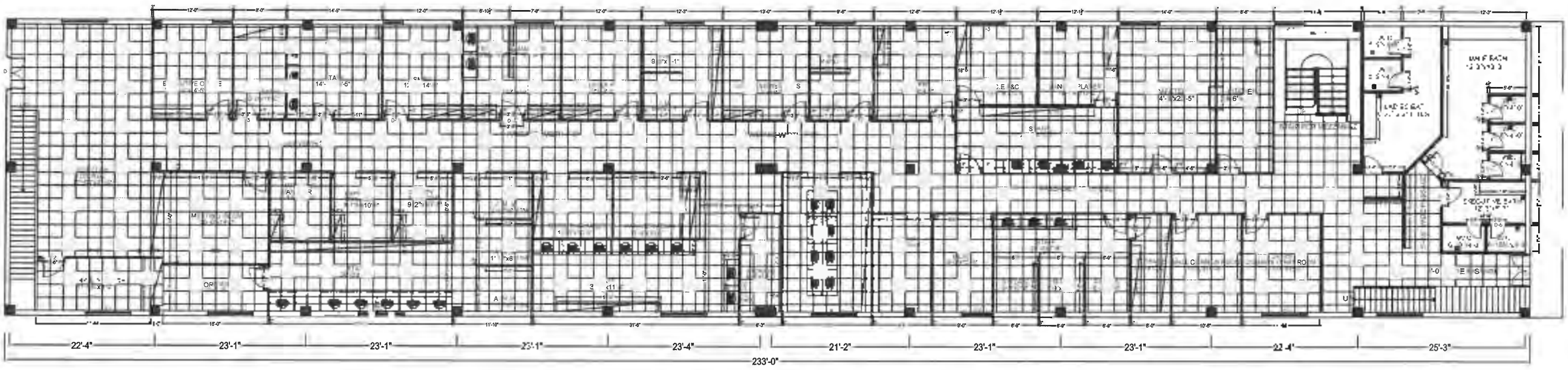
CONTACT NO: +92-346-4666555



Client: Head Office Building At Sundar Lahore Punjab Industrial Estate Development & Management Company	Tittle: A-C WIRING SYSTEM LAYOUT OF GROUND FLOOR	Rev no 00	Design By [illegible]	Date: [illegible]	J&M Architects & Interior Designer 365 - E Johar Town Lahore Contact: +923323674154 Email: myraxx@gmail.com
		Rev no 00-00-000	Drawn By YUNSIN RAZA	DWG No. E-GF 01	

INTERNATIONAL ENGINEERS
CHARTERED ELECTRICAL ENGINEERS & CONSULTANTS

J & M Associates
365-F, Johar Town
Lahore-Pakistan
Mobile #: 0346-4666555
Mobile #: 0346-4050555



Client:
Head Office Building A1 Sundar Lahore
Punjab Industrial Estate Development & Management Company

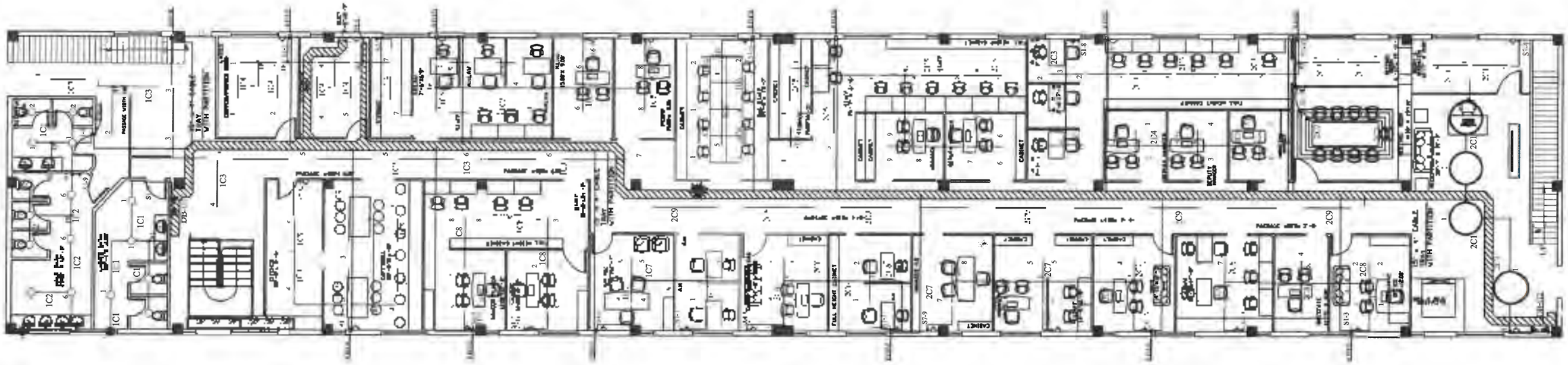
Tiltle.
2'X2' LED PANEL LAYOUT GROUND FLOOR

Rev no	Design By.	Date
00	MAQSOOD AHMAD	[illegible]
Rev no	Drawn By.	DWG No
00-00-000	[illegible]	E-GF-02

J&M
Architects & Interior Designer
365 - E Johar Town Lahore
Contact +923023074154
Email myraxx@gmail.com

INTERNATIONAL ENGINEER
CHARTERED ELECTRICAL ENGINEERS & CONSULTANTS
[illegible]

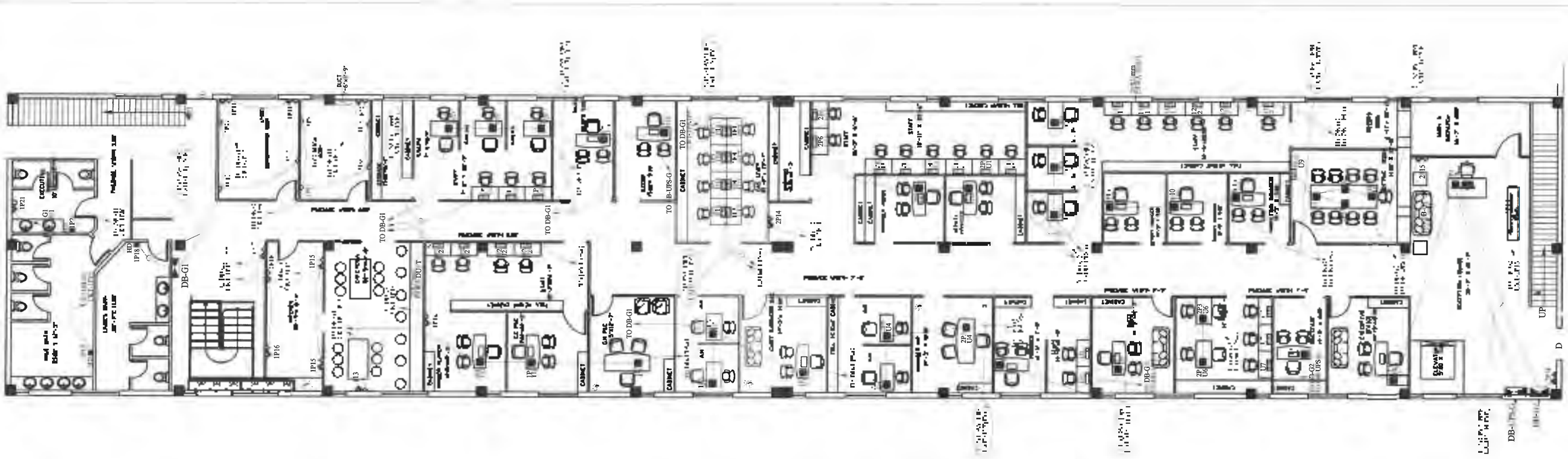
J & M Associates
365-E, Johar Town
Lahore
Mobile: 0346-4050555



Client: Head Office Building At Sundar Lahore Punjab Industrial Estate Development & Management Company	Tiltle. LIGHTING CIRCUIT LAYOUT OF GROUND FLOOR	Rev no 00 Rev no 00-00-000	Design By Drawn By	Date. DWG No E GF 03	J&M	Architects & Interior Designer 365 - E Johar Town Lahore Contact +923039574154 Email myraxx@gmail.com

INTERNATIONAL ENGINEERS
CHARTERED ELECTRICAL ENGINEERS & CONSULTANTS

J & M Associates
365-E, Johar Town
3666555
3350555

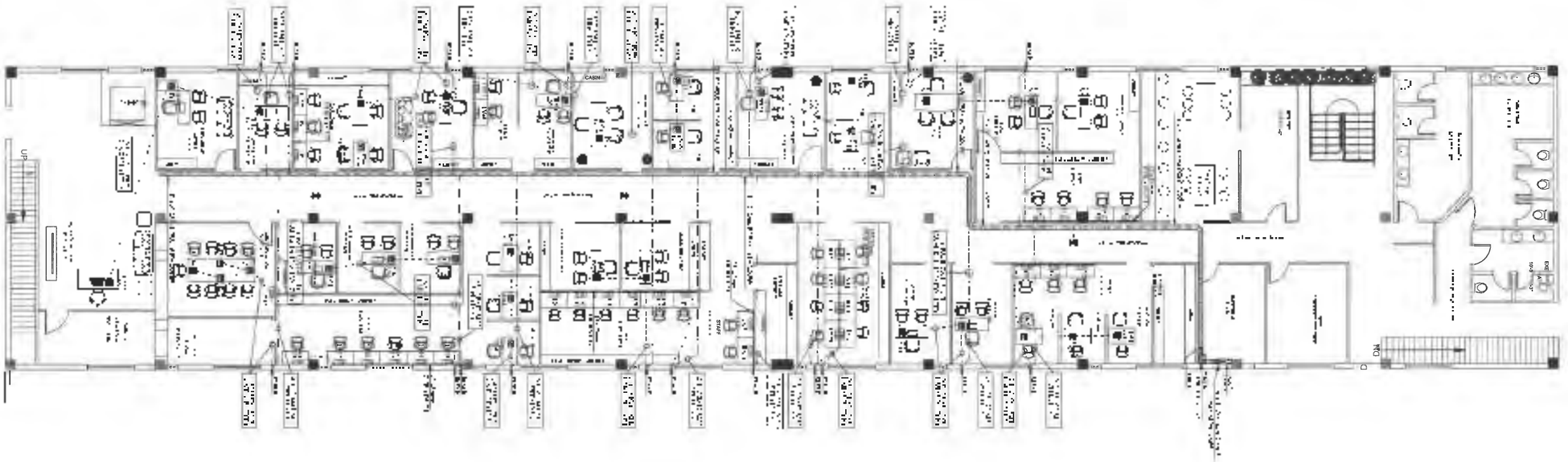


Client: Head Office Building At Sundar Lahore Punjab Industrial Estate Development & Management Company	Tittle: POWER & UPS SYSTEM LAYOUT OF GROUND FLOOR	Rev no: 00	Design By: [illegible]	Date [illegible]
		Rev no 00-00-000	Drawn By KHALID	DWG No E-(G)-04

J&M
Architects & Interior Designer
365 - B Johar Town Lahore
Contact +923323674164
Email: myraxx@gmail.com

INTERNATIONAL ENGINEER
CHARTERED ELECTRICAL ENGINEERS & CONSULTANTS

J & M Associates
365-B, J[illegible]
Lahore[illegible]
Mobile #: 0[illegible]4666555
Mobile #: 03[illegible]4050555



NOTE
1 FOR FURTHER GENERAL NOTES SEE DRG NO. A-1 & A-2

J & M Associates
365-E, Johar Town
Lahore

TITLE: GROUND FLOOR VOICE & DATA SYSTEM LAYOUT	PRINCIPAL ARCHITECT	REVISION			SCALE: 1/8"=1'-0"	DRAWING No: FX HO18-ELEC	DRAWN BY: RAFAQAT	N
DESIGN FOR PIDMEC	PROJECT ARCHITECT	S.NO	DATE	REMARKS	DATE: FEB 2025	SHEET No: E.16	CHECK BY:	
DISTRICT LAHORE	ASSISTANT ARCHITECT							

J & M ASSOCIATES
ARCHITECTS & ENGINEERS
OFFICE NO.365 - E
MAJOHER TOWN
LAHORE