



**Project Office
Khairpur Special Economic Zone (KSEZ)
District Khairpur
Government of Sindh**

Infrastructure Development Works at Khairpur Special Economic Zone (KSEZ)



BIDDING DOCUMENT

**FOR
CONSTRUCTION OF MAIN ELECTRICAL SUB-STATION,
COMPLETE CIVIL & ELECTRICAL WORKS, INCLUDING
SUB-STATION EQUIPMENTS**

Volume-I: Conditions of Contract

Volume-II: Specifications

Volume-III: Bill of Quantities

Volume-IV: Drawings



EA Consulting Pvt Ltd

(Formerly Engineering Associates)

Engineering, Architecture & Project Management

**Head Office: AL-9, 15th Lane, Khayaban-e-Hilal,
Phase VII, D.H.A., Karachi-75500.,**

Tel: UAN: 111-111-584, Fax: (021) 3584-1825

June, 2016

**PROJECT OFFICE, KSEZ
KHAIRPUR SPECIAL ECONOMIC ZONE
DISTRICT KHAIRPUR, GOVERNMENT OF SINDH**

BIDDING DOCUMENT

For

**Construction of Main Electrical Sub-Station,
Complete Civil & Electrical Works, Including
Sub-Station Equipments.**

VOLUME-I



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**Head Office: AL-9, 15th Lane, Khayaban-e-Hilal,
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BIDDING DOCUMENTS

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Notice Inviting Tender

“ Construction of Main Electrical Sub-Station, Complete Civil & Electrical Works, Including Sub-Station Equipment’s.”

Project Office Khairpur Special Economic Zone (KSEZ), District Khairpur, Government of Sindh (the “Employer”) invites, sealed Bids on item rate basis from interested contractors/firms for their Project “Construction of Main Electrical Sub-Station, Complete Civil & Electrical Works, Including Sub-Station Equipment’s.”

S. No	Name of Work	Bid Security	Tender Fee	Time for Completion
1.	<u>Construction of Main Electrical Sub-Station, Complete Civil & Electrical Works, Including Sub-Station Equipment’s.”</u>	2 % of Tender Cost	Pak Rs.3000 /-	6 Months

1. **Eligibility:** The interested bidders must have the following qualifications (documentary evidences to be submitted with their Bids):

- a. Valid Pakistan Engineering Council (PEC) registration in Category C5 & above, and in discipline CE10 & EE05.
- b. Valid NTN Certificate from Income Tax Authorities.
- c. Valid Sales Tax Registration Certificate.
- d. Valid Professional Tax Certificate.
- e. Should be in construction business for last 5 years or more.
- f. Should not be Blacklisted or engaged in any Litigation on any project.
- g. Should have completed two contracts of similar nature and value of Pak Rs.50 million each in last 5 years.
- h. Annual Construction Turnover for last three years of Pak RS.7.5 million.

2. **Method of Procurement.** *Single Stage - Single Envelope*

3. **Bidding/Tender Documents:**

- (i) **Issuance:** Documents will be issued from date of publication on payment of tender fee (*Non-refundable*) from NIP head office.
- (ii) **Submission:** Last date will be _____ (As per NIT).
- (iii) **Opening:** will be opened on _____ (As per NIT)

4. Terms & Conditions.

- (a) Under following conditions bid will be rejected:-
- (i) Bid not meeting eligibility criteria as stated above
 - (ii) Conditional and telegraphic bids/tenders;
 - (iii) Bids not accompanied by bid security of required amount and form;
 - (iv) Bids received after specified date and time.
 - (v) Black listed firms.
 - (vi) Bid not meeting minimum post qualification requirements as stated in the Bidding Document.
- (b) **Bid validity Period:** - (90) Ninety days.
- (c) Procuring Agency reserves the right to reject all or any bids subject to the relevant provisions of Sindh Public Procurement Rules 2010.
- (d) **Responsive Bidder is required to submit following documents with bid: (Minimum requirement is stated in the Bidding Document)**
- (i) List of similar assignments completed projects and in hand with cost under-taken in the past five (05) years;
 - (ii) *Details of equipments, machineries and transport Deployed at site by firm/contractor;*
 - (iii) List of technical and administrative staff on their permanent strength with CV mentioning qualification, general and relevant experience with mention of staff proposed for the Project
 - (iii) Financial Statement (summary) and income tax return for the last three- years;
 - (iv) Affidavit that firm has never been black listed;

The Bidding and Contract Documents with Drawings will be collected and returned as per said dates to the following address:

Chief Executive Officer, NIP

National Industrial Parks Development and Management Company, 2nd Floor, Block C, FTC Building, Shah rah-e-Faisal Karachi-74400, Pakistan,

Tel: 99205035-9

**INSTRUCTIONS
TO BIDDERS
&
BIDDING DATA**

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INSTRUCTIONS TO BIDDERS

A. GENERAL

IB.1 Scope of Bid & Source of Funds

1.1 Scope of Bid

The Procuring Agency as defined in the Bidding Data (hereinafter called "the Procuring Agency") wishes to receive Bids for the Works summarized in the Bidding Data (hereinafter referred to as "the Works").

Bidders must quote for the complete scope of work. Any Bid covering partial scope of work will be rejected as non-responsive.

1.2 Source of Funds

The Procuring Agency has arranged funds from its own sources or Federal/ Provincial /Donor agency or any other source, which may be indicated accordingly in bidding data towards the cost of the project/scheme.

IB.2 Eligible Bidders

2.1 Bidding is open to all firms and persons meeting the following requirements:

- (i) Valid Pakistan Engineering Council (PEC) registration in Category C5 & above, and in discipline CE09 & CE10.
- (ii) Valid NTN Certificate from Income Tax Authorities.
- (iii) Valid Sales Tax Registration Certificate.
- (iv) Valid Professional Tax Certificate.
- (v) List of similar assignments completed projects and in hand with cost under-taken in the past five (05) years;
- (ii) *Details of equipments, machineries and transport Deployed at site by firm/contractor;*
- (iii) List of technical and administrative staff on their permanent strength with CV mentioning qualification, general and relevant experience with mention of staff proposed for the Project
- (iii) Financial Statement (summary) and income tax return for the last three- years;
- (v) Affidavit that firm has never been black listed;

IB.3 Cost of Bidding

- 3.1 The bidder shall bear all costs associated with the preparation and submission of its bid and the Procuring Agency will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process (SPP Rules 24 & 25).

B. BIDDING DOCUMENTS

IB.4 Contents of Bidding Documents

4.1 In addition to Invitation for Bids, the Bidding Documents are those stated below, and should be read in conjunction with any Addendum issued in accordance with Sub-Clause IB.6.1.

- 1 Instructions to Bidders & Bidding Data
2. Form of Bid, Qualification Information & Schedules to Bid.

Schedules to Bid comprise the following:

- (i) Schedule A: Schedule of Prices/ Bill of Quantities (BOQ).
 - (ii) Schedule B: Specific Works Data
 - (iii) Schedule C: Works to be Performed by Subcontractors
 - (iv) Schedule D: Proposed Programme of Works
 - (v) Schedule E: Method of Performing Works
 - (vi) Schedule F: Integrity Pact (works costing Rs 10 million and above)
- 3 Conditions of Contract & Contract Data
 4. Standard Forms:
 - (i) Form of Bid Security,
 - (ii) Form of Performance Security;
 - (iii) Form of Contract Agreement;
 - (iv) Form of Bank Guarantee for Advance Payment.
 - 5 Specifications
 - 6 Drawings, if any

IB.5 Clarification of Bidding Documents

5.1 A prospective bidder requiring any clarification(s) in respect of the Bidding Documents may notify the Engineer/Procuring Agency at the Engineer's/ Procuring Agency's address indicated in the Bidding Data.

5.2 An interested bidder, who has obtained bidding documents, may request for clarification of contents of bidding documents in writing and procuring agency shall respond to such queries in writing within three calendar days, provided they are received at least five calendar days prior to the date of opening of bid (SPP Rule 23-1).

IB.6 Amendment of Bidding Documents (SPP Rules 22(2) & 22).

- 6.1 At any time prior to the deadline for submission of Bids, the Procuring Agency may, for any reason, whether at his own initiative or in response to a clarification requested by a interested bidder, modify the Bidding Documents by issuing addendum.
- 6.2 Any addendum thus issued shall be part of the Bidding Documents pursuant to Sub-Clause 6.1 hereof, and shall be communicated in writing to all purchasers of the Bidding Documents. Prospective bidders shall acknowledge receipt of each addendum in writing to the Procuring Agency.
- 6.3 To afford interested bidders reasonable time in which to take an addendum into account in preparing their Bids, the Procuring Agency may at its discretion extend the deadline for submission of Bids.

C. PREPARATION OF BIDS

IB.7 Language of Bid

- 7.1 All documents relating to the Bid shall be in the language specified in the Contract Data.

IB.8 Documents Comprising the Bid

- 8.1 The Bid submitted by the bidder shall comprise the following:
- (a) Offer /Covering Letter
 - (b) Form of Bid duly filled, signed and sealed, in accordance with IB.14.3.
 - (c) Schedules (A to F) to Bid duly filled and initialed, in accordance with the instructions contained therein & in accordance with IB.14.3.
 - (d) Bid Security furnished in accordance with IB.13.
 - (e) Power of Attorney in accordance with IB 14.5.
 - (f) Documentary evidence in accordance with IB.2(c) & IB.11
 - (g) Documentary evidence in accordance with IB.12.

IB.9 Sufficiency of Bid

- 9.1 Each bidder shall satisfy himself before Bidding as to the correctness and sufficiency of his Bid and of the premium on the rates of CSR / rates and prices quoted/entered in the Schedule of Prices, which rates and prices shall except in so far as it is otherwise expressly provided in the Contract, cover all his obligations under the Contract and all matters and things necessary for the proper completion of the works.
- 9.2 The bidder is advised to obtain for himself at his own cost and responsibility all information that may be necessary for preparing the bid and entering into a Contract for execution of the Works.

IB.10 Bid Prices, Currency of Bid and Payment

- 10.1 The bidder shall fill up the Schedule of Prices (Schedule A to Bid) indicating the percentage above or below the Composite Schedule of Rates/unit rates and prices of the Works to be performed under the Contract. Prices in the Schedule of Prices/Bill of Quantities shall be quoted entirely in Pak Rupees keeping in view the instructions contained in the Preamble to Schedule of Prices.
- 10.2 Unless otherwise stipulated in the Conditions of Contract, prices quoted by the bidder shall remain fixed during the bidder's performance of the Contract and not subject to variation on any account.

- 10.3 The unit rates and prices in the Schedule of Prices or percentage above or below on the composite schedule of rates shall be quoted by the bidder in the currency as stipulated in Bidding Data.
- 10.4 Items for which no rate or price is entered by the Bidder will not be paid for by the Procuring Agency when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities.

IB.11 Documents Establishing Bidder's Eligibility and Qualifications

- 11.1 Pursuant to Clause IB.8, the bidder shall furnish, as part of its bid, documents establishing the bidder's eligibility to bid and its qualifications to perform the Contract if its bid is accepted.
- 11.2 Bidder must possess and provide evidence of its capability and the experience as stipulated in Bidding Data and the Qualification Criteria mentioned in the Bidding Documents.

IB.12 Documents Establishing Works' Conformity to Bidding Documents

- 12.1 The documentary evidence of the Works' conformity to the Bidding Documents may be in the form of literature, drawings and data and the bidder shall furnish documentation as set out in Bidding Data.
- 12.2 The bidder shall note that standards for workmanship, material and equipment, and references to brand names or catalogue numbers, if any, designated by the Procuring Agency in the Technical Provisions are intended to be descriptive only and not restrictive.

IB.13 Bid Security

- 13.1 Each bidder shall furnish, as part of his bid, at the option of the bidder, a Bid Security as percentage of bid price/estimated cost or in the amount stipulated in Bidding Data in Pak. Rupees in the form of Deposit at Call/ Payee's Order or a Bank Guarantee issued by a Scheduled Bank in Pakistan in favour of the Procuring Agency valid for a period up to twenty eight (28) days beyond the bid validity date (Bid security should not be below 1% and not exceeding 5% of bid price/estimated cost SPP Rule 37).
- 13.2 Any bid not accompanied by an acceptable Bid Security shall be rejected by the Procuring Agency as non-responsive.
- 13.3 The bid securities of unsuccessful bidders will be returned upon award of contract to the successful bidder or on the expiry of validity of Bid Security whichever is earlier.
- 13.4 The Bid Security of the successful bidder will be returned when the bidder has furnished the required Performance Security, and signed the Contract Agreement (SPP Rule 37).

- 13.5 The Bid Security may be forfeited:
- (a) if a bidder withdraws his bid during the period of bid validity; or
 - (b) if a bidder does not accept the correction of his Bid Price, pursuant to Sub-Clause 16.4 (b) hereof; or
 - (c) in the case of a successful bidder, if he fails within the specified time limit to:
 - (i) furnish the required Performance Security or
 - (ii) sign the Contract Agreement.

IB.14 Validity of Bids, Format, Signing and Submission of Bid

- 14.1 Bids shall remain valid for the period stipulated in the Bidding Data after the date of bid opening.
- 14.2 In exceptional circumstances, Procuring Agency may request the bidders to extend the period of validity for an additional period but not exceeding 1/3 of the original period. The request and the bidders' responses shall be made in writing or by cable. A Bidder may refuse the request without forfeiting the Bid Security. A Bidder agreeing to the request will not be required or permitted to otherwise modify the Bid, but will be required to extend the validity of Bid Security for the period of the extension, and in compliance with IB.13 in all respects (SPP Rule 38).
- 14.3 All Schedules to Bid are to be properly completed and signed.
- 14.4 No alteration is to be made in the Form of Bid except in filling up the blanks as directed. If any alteration be made or if these instructions be not fully complied with, the bid may be rejected.
- 14.5 Each bidder shall prepare Original and number of copies specified in the Bidding Data of the documents comprising the bid as described in IB.8 and clearly mark them "ORIGINAL" and "COPY" as appropriate. In the event of discrepancy between them, the original shall prevail.
- 14.6 The original and all copies of the bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign (in the case of copies, Photostats are also acceptable). This shall be indicated by submitting a written Power of Attorney authorising the signatory of the bidder to act for and on behalf of the bidder. All pages of the bid shall be initialed and official seal be affixed by the person or persons signing the bid.
- 14.7 The Bid shall be delivered in person or sent by registered mail at the address to Procuring Agency as given in Bidding Data.

D. SUBMISSION OF BID**IB.15 Deadline for Submission, Modification & Withdrawal of Bids**

- 15.1 Bids must be received by the Procuring Agency at the address/provided in Bidding Data not later than the time and date stipulated therein.
- 15.2 The inner and outer envelopes shall
- (a) be addressed to the Procuring Agency at the address provided in the Bidding Data;
 - (b) bear the name and identification number of the Contract as defined in the Bidding and Contract Data; and
 - (c) provide a warning not to open before the specified time and date for Bid opening as defined in the Bidding Data.
 - (d) in addition to the identification required in 15.2, the inner envelopes shall indicate the name and address of the Bidder to enable the Bid to be returned unopened in case it is declared late.
 - (e) If the outer envelope is not sealed and marked as above, the Procuring Agency will assume no responsibility for the misplacement or premature opening of the Bid.
- 15.3 Bids submitted through telegraph, telex, fax or e-mail shall not be considered.
- 15.4 Any bid received by the Procuring Agency after the deadline for submission prescribed in Bidding Data will be returned unopened to such bidder.
- 15.5 Any bidder may modify or withdraw his bid after bid submission provided that the modification or written notice of withdrawal is received by the Procuring Agency prior to the deadline for submission of bids.
- 15.6 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 pursuant to IB.13.5 (a).

E. BID OPENING AND EVALUATION

IB.16 Bid Opening, Clarification and Evaluation (SPP Rules 41, 42 & 43)

16.1 The Procuring Agency will open the bids, in the presence of bidders' representatives who choose to attend, at the time, date and in the place specified in the Bidding Data.

16.2 The bidder's name, Bid Prices, any discount, the presence or absence of Bid Security, and such other details as the Procuring Agency at its discretion may consider appropriate, will be announced by the Procuring Agency at the bid opening. The Procuring Agency will record the minutes of the bid opening. Representatives of the bidders who choose to attend shall sign the attendance sheet.

Any Bid Price or discount which is not read out and recorded at bid opening will not be taken into account in the evaluation of bid.

16.3 To assist in the examination, evaluation and comparison of Bids the Engineer/Procuring Agency may, at its discretion, ask the bidder for a clarification of its Bid. The request for clarification and the response shall be in writing and no change in the price or substance of the Bid shall be sought, offered or permitted (SPP Rule 43).

16.4 (a) Prior to the detailed evaluation, pursuant to IB.16.7 to 16.8, the Engineer/Procuring Agency will determine the substantial responsiveness of each bid to the Bidding Documents. For purpose of these instructions, a substantially responsive bid is one which conforms to all the terms and conditions of the Bidding Documents without material deviations. It will include determining the requirements listed in Bidding Data.

(b) Arithmetical errors will be rectified on the following basis:

If there is a discrepancy between the unit price and total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected. If there is a discrepancy between the words and figures the amount in words shall prevail. If there is a discrepancy between the Total Bid price entered in Form of Bid and the total shown in Schedule of Prices-Summary, the amount stated in the Form of Bid will be corrected by the Procuring Agency in accordance with the Corrected Schedule of Prices.

If the bidder does not accept the corrected amount of Bid, his Bid will be rejected and his Bid Security forfeited.

16.5 A Bid determined as substantially non-responsive will be rejected and will not subsequently be made responsive by the bidder by correction of the non-conformity.

16.6 Any minor informality or non-conformity or irregularity in a Bid which does not constitute a material deviation (major deviation) may be waived by Procuring Agency, provided such waiver does not prejudice or affect the relative ranking of any other bidders.

(A) **Major (material) Deviations include:**

- (i) has been not properly signed;
- (ii) is not accompanied by the bid security of required amount and manner;
- (iii) stipulating price adjustment when fixed price bids were called for;
- (iv) failing to respond to specifications;
- (v) failing to comply with Mile-stones/Critical dates provided in Bidding Documents;
- (vi) sub-contracting contrary to the Conditions of Contract specified in Bidding Documents;
- (vii) refusing to bear important responsibilities and liabilities allocated in the Bidding Documents, such as performance guarantees and insurance coverage;
- (viii) taking exception to critical provisions such as applicable law, taxes and duties and dispute resolution procedures;
- (ix) a material deviation or reservation is one :
 - (a) which affect in any substantial way the scope, quality or performance of the works;
 - (b) adoption/rectification whereof would affect unfairly the competitive position of other bidders presenting substantially responsive bids.

(B) **Minor Deviations**

Bids that offer deviations acceptable to the Procuring Agency and which can be assigned a monetary value may be considered substantially responsive at least as to the issue of fairness. This value would however be added as an adjustment for evaluation purposes only during the detailed evaluation process.

16.7 The Engineer/Procuring Agency will evaluate and compare only the bids previously determined to be substantially responsive pursuant to IB.16.4 to 16.6 as per requirements given hereunder. Bids will be evaluated for complete scope of works. The prices will be compared on the basis of the Evaluated Bid Price pursuant to IB.16.8 herein below.

Technical Evaluation: It will be examined in detail whether the works offered by the bidder complies with the Technical Provisions of the Bidding Documents. For this purpose, the bidder's data submitted with the bid in

Schedule B to Bid will be compared with technical features/criteria of the works detailed in the Technical Provisions. Other technical information submitted with the bid regarding the Scope of Work will also be reviewed.

16.8 Evaluated Bid Price

In evaluating the bids, the Engineer/Procuring Agency will determine for each bid in addition to the Bid Price, the following factors (adjustments) in the manner and to the extent indicated below to determine the Evaluated Bid Price:

- (i) making any correction for arithmetic errors pursuant to IB.16.4 hereof.
- (ii) discount, if any, offered by the bidders as also read out and recorded at the time of bid opening.
- (iii) excluding provisional sums and the provisions for contingencies in the Bill of Quantities if any, but including Day work, where priced competitively.

IB.17 Process to be Confidential

17.1 Subject to IB.16.3 heretofore, no bidder shall contact Engineer/Procuring Agency on any matter relating to its Bid from the time of the Bid opening to the time the bid evaluation result is announced by the Procuring Agency. The evaluation result shall be announced at least seven (07) days prior to award of Contract (SPP Rule 45). The announcement to all bidders will include table(s) comprising read out prices, discounted prices, price adjustments made, final evaluated prices and recommendations against all the bids evaluated.

17.2 Any effort by a bidder to influence Engineer/Procuring Agency in the Bid evaluation, Bid comparison or Contract Award decisions may result in the rejection of his Bid. Whereas any bidder feeling aggrieved, may lodge a written complaint to Complaint Redressal Committee as per terms and conditions mentioned in SPP Rules 31 & 32. However, mere fact of lodging a complaint shall not warrant suspension of procurement process.

17.3 Bidders may be excluded if involved in "Corrupt and Fraudulent Practices" means either one or any combination of the practices given below SPP Rule2(q);

(i) "Coercive Practice" means any impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence the actions of a party to achieve a wrongful gain or to cause a wrongful loss to another party;

(ii) "Collusive Practice" means any arrangement between two or more parties to the procurement process or contract execution, designed to achieve with or without the knowledge of the procuring agency to establish prices at artificial, noncompetitive levels for any wrongful gain;

(iii) "Corrupt Practice" means the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence the acts of another party for wrongful gain;

(iv) "Fraudulent Practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

(v) "Obstructive Practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in a procurement process, or affect the execution of a contract or deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements before investigators in order to materially impede an investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or acts intended to materially impede the exercise of inspection and audit rights provided for under the Rules.

F. AWARD OF CONTRACT

IB.18. Post Qualification

- 18.1 The Procuring Agency, at any stage of the bid evaluation, having credible reasons for or prima facie evidence of any defect in contractor's capacities, may require the contractors 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 therefore in writing. They shall form part of the records of that bid evaluation report.

- 18.2 The determination will take into account the bidder's financial and technical capabilities. It will be based upon an examination of the documentary evidence of the bidders' qualifications submitted under B.11, as well as such other information required in the Bidding Documents.

IB.19 Award Criteria & Procuring Agency's Right

- 19.1 Subject to IB.19.2, the Procuring Agency will award the Contract to the bidder whose bid has been determined to be substantially responsive to the Bidding Documents and who has offered the lowest evaluated Bid Price, provided that such bidder has been determined to be qualified to satisfactorily perform the Contract in accordance with the provisions of the IB.18.

- 19.2 Notwithstanding IB.19.1, the Procuring Agency reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids, at any time prior to award of Contract, without thereby incurring any liability to the affected bidders or any obligation to inform the affected bidders of the grounds for the Procuring Agency's action except that the grounds for its rejection of all bids shall upon request be communicated, to any bidder who submitted a bid, without justification of the grounds. Notice of the rejection of all the bids shall be given promptly to all the bidders (SPP Rule 25).

IB.20 Notification of Award & Signing of Contract Agreement

- 20.1 Prior to expiration of the period of bid validity prescribed by the Procuring Agency, the Procuring Agency will notify the successful bidder in writing ("Letter of Acceptance") that his bid has been accepted (SPP Rule 49).
- 20.2 Within seven (07) days from the date of furnishing of acceptable Performance Security under the Conditions of Contract, the Procuring Agency will send the successful bidder the Form of Contract Agreement provided in the Bidding Documents, incorporating all agreements between the parties.

- 20.3 The formal Agreement between the Procuring Agency and the successful bidder duly stamped at rate of 0.03 % of bid price (updated from time to time) stated in Letter of Acceptance shall be executed within seven (07) days of the receipt of Form of Contract Agreement by the successful bidder from the Procuring Agency.

IB.21 Performance Security

- 21.1 The successful bidder shall furnish to the Procuring Agency a Performance Security in the form and the amount stipulated in the Conditions of Contract within a period of fourteen (14) days after the receipt of Letter of Acceptance (SPP 39).
- 21.2 Failure of the successful bidder to comply with the requirements of Sub-Clauses IB.20.2 & 20.3 or 21.1 or Clause IB.22 shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security.
- 21.3 Publication of Award of Contract: within seven days of the award of contract, the procuring shall publish on the website of the authority and on its own website, if such a website exists, the results of the bidding process, identifying the bid through procurement identifying Number if any and the following information:
- (1) Evaluation Report;
 - (2) Form of Contract and letter of Award;
 - (3) Bill of Quantities or Schedule of Requirements. (SPP Rule 50)

IB.22 Integrity Pact

The Bidder shall sign and stamp the Form of Integrity Pact provided at Schedule-F to Bid in the Bidding Document for all Sindh Government procurement contracts exceeding Rupees ten (10) million. Failure to provide such Integrity Pact shall make the bid non-responsive (SPP Rule 89).

BIDDING DATA

Instructions to Bidders Clause Reference

1.1 Name of Procuring Agency

Project Office, KSEZ

Khairpur Special Economic Zone
Khairpur District Council Office,
Near Radio Pakistan Office old National Highway, District Khaipur
Phone: 0243-9280398-400, 554449
Fax: 0234-9280396

Brief Description of Works

Construction of Main Electrical Sub-Station, Complete Civil & Electrical Works, Including Sub-Station Equipment's.

2.1 PEC category C5 and above in discipline CE-10 & EE05

5.1 (a) Procuring Agency's address:

Khairpur Special Economic Zone
Khairpur District Council Office,
Near Radio Pakistan Office old National Highway, District
Khaipur
Phone: 0243-9280398-400, 554449
Fax: 0234-9280396

(b) Engineer's address:

EA Consulting Pvt Limited
AL-9, 15th Lane, off Khayaban-e-Hilal, Phase VII, DHA,
Karachi.

7.1 Bid language: English

10.3 Bid shall be quoted entirely in Pak. Rupees. The payment shall be made in Pak. Rupees.

11.2 The bidder must furnish and provide followings:

- I. Valid PEC Category C5 and Above In Discipline CE-10 & EE05.
- II. NTN Certificate Of The Firm
- III. Registration Certificate from SBR.
- IV. Professional Tax Certificate
- V. Company Profile (information about construction equipment's & key personals, who will be deputed on this particular project along with their CV's and documentary evidence of their educational certificates.

-
- VI. Certify Copy Of Annual Construction Turnover Of Last Three Years
 - VII. Completion Certificate Of Two Contracts Of Similar Nature In Last 5 Years.
 - VIII. Qualified Engineer (B.E) 1.No. and Diploma Engineer (DAE) 2No.
 - IX. Surveying Equipment (Including Total Station) [02 Set]
 - X. Concrete Mixer Machine (2 No.)
 - XI. Water Bowser (02 No.)
 - XII. Wooden shuttering (4000 Sft)
- 12.1 (a) A detailed description of the Works, essential technical and performance characteristics.
- (b) Complete set of technical information, description data, literature and drawings as required in accordance with Schedule B to Bid, Specific Works Data. This will include but not be limited to a sufficient number of drawings, photographs, catalogues, illustrations and such other information as is necessary to illustrate clearly the significant characteristics such as general construction dimensions and other relevant information about the works to be performed.
- 13.1 Amount of Bid Security**
- 2% of the Bid Price in the form of Deposit at Call/ Payee's Order or a Bank Guarantee issued by a Scheduled Bank in Pakistan in favor of Procuring Agency (Project Office, KSEZ)
- 14.1 Period of Bid Validity**
- 90 days
- 14.4 Number of Copies of the Bid to be submitted:**
- One original and Two copy only
- 14.6 Procuring Agency's Address for the Purpose of Bid Submission**
- As per Notice Inviting Bids
- 15.1 Deadline for Submission of Bids**
- As per Notice Inviting Bids
- 15.2 Name and Identification Number**
- Construction of Main Electrical Sub-Station, Complete Civil & Electrical Works, Including Sub-Station Equipment's.
- 16.1 Venue, Time, and Date of Bid Opening**

Venue: as stated in IB 14.6 above
As per Notice Inviting Bids

16.4 Responsiveness of Bids

- (i) Bid is valid till required period,
- (ii) Bid prices are firm during currency of contract;
- (iii) Completion period offered is within specified limits,
- (iv) Bidder is eligible to Bid and possesses the requisite experience, capability and qualification.
- (v) Bid does not deviate from basic technical requirements and
- (vi) Bids are generally in order, etc.

FORM OF BID AND SCHEDULES TO BID

FORM OF BID (LETTER OF OFFER)

Bid Reference No. _____

(Name of Works)

To:

Gentlemen,

- 1 Having examined the Bidding Documents including Instructions to Bidders, Bidding Data, Conditions of Contract, Contract Data, Specifications, Drawings, if any, Schedule of Prices and Addenda Nos. _____ for the execution of the above-named works, we, the undersigned, being a company doing business under the name of and address _____ and being duly incorporated under the laws of Pakistan hereby offer to execute and complete such works and remedy any defects therein in conformity with the said Documents including Addenda thereto for the Total Bid Price of Rs _____ (Rupees _____) or such other sum as may be ascertained in accordance with the said Documents.
- 2 We understand that all the Schedules attached hereto form part of this Bid.
- 3 As security for due performance of the undertakings and obligations of this Bid, we submit herewith a Bid Security in the amount of _____ drawn in your favour or made payable to you and valid for a period of twenty eight (28) days beyond the period of validity of Bid.
- 4 We undertake, if our Bid is accepted, to commence the Works and to deliver and complete the Works comprised in the Contract within the time(s) stated in Contract Data.
- 5 We agree to abide by this Bid for the period of _____ days from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

- 6 Unless and until a formal Agreement is prepared and executed, this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.
- 7 We undertake, if our Bid is accepted, to execute the Performance Security referred to in Conditions of Contract for the due performance of the Contract.
- 8 We understand that you are not bound to accept the lowest or any bid you may receive.
- 9 We do hereby declare that the Bid is made without any collusion, comparison of figures or arrangement with any other person or persons making a bid for the Works.

Dated this _____ day of _____, 20

Signature _____

in the capacity of _____ duly authorized to sign bid for and on behalf of
(Name of Bidder in Block Capitals)

(Seal)

Address

Witness:

(Signature) _____

Name:

Address:

SCHEDULES TO BID INCLUDE THE FOLLOWING:

- Schedule A to Bid: Schedule of Prices
- Schedule B to Bid: Specific Works Data
- Schedule C to Bid: Works to be Performed by Subcontractors
- Schedule D to Bid: Proposed Program of Works
- Schedule E to Bid: Method of Performing Works
- Schedule F to Bid: Integrity Pact

SCHEDULE – A TO BID

SCHEDULE OF PRICES

Sr.No.		Page No.
1	Preamble to Schedule of Prices.....	24
2	Schedule of Prices.....	26
	(a) Summary of Bid Prices	
	(b) Detailed Schedule of Prices /Bill of Quantities (BOQ)	

SEPARATELY BOUNDED

SCHEDULE -A TO BID**PREAMBLE TO SCHEDULE OF PRICES****1. General**

- 1.1 The Schedule of Prices shall be read in conjunction with the Conditions of Contract, Contract Data together with the Specifications and Drawings, if any.
- 1.2 The Contract shall be for the whole of the works as described in these Bidding Documents. Bids must be for the complete scope of works.

2. Description

- 2.1 The general directions and descriptions of works and materials are not necessarily repeated nor summarized in the Schedule of Prices. References to the relevant sections of the Bidding Documents shall be made before entering prices against each item in the Schedule of Prices.

3 Units & Abbreviations

- 3.1 Units of measurement, symbols and abbreviations expressed in the Bidding Documents shall comply with the System International Unites (SI Units).

4. Rates and Prices

- 4.1 Except as otherwise expressly provided under the Conditions of Contract, the rates and amounts entered in the Schedule of Prices shall be the rates at which the Contractor shall be paid and shall be the full inclusive value of the works set forth or implied in the Contract; except for the amounts reimbursable, if any to the Contractor under the Contract.
- 4.2 Unless otherwise stipulated in the Contract Data, rates and prices entered by the bidder shall not be subject to adjustment during the performance of the Contract.
- 4.3 All duties, taxes and other levies payable by the Contractor shall be included in the rates and prices.
- 4.4 The whole cost of complying with the provisions of the Contract shall be included in the items provided in the Schedule of Prices, 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 the Works and no separate payment will be made for those items.

The rates, prices and amounts shall be entered against each item in the Schedule of Prices. Any item against which no rate or price is entered by the bidder will not be paid for by the Procuring Agency when executed and shall be deemed covered by the rates and prices for other items in the Schedule of Prices.

- 4.5 (a) The bidder shall be deemed to have obtained all information as to and all requirements related thereto which may affect the bid price.
- (b) The Contractor shall be responsible to make complete arrangements for the transportation of the Plant to the Site.
- 4.6 The Contractor shall provide for all parts of the Works to be completed in every respect. Notwithstanding that any details, accessories, etc. required for the complete installation and satisfactory operation of the Works, are not specifically mentioned in the Specifications, such details shall be considered as included in the Contract Price.

5. Bid Prices

5.1 Break-up of Bid Prices

The various elements of Bid Prices shall be quoted as detailed by the Procuring Agency in the format of Schedule of Prices. The bidder shall recognize such elements of the costs which he expects to incur the performance of the Works and shall include all such costs in the rates and amounts entered in the Schedule of Prices.

5.2 Total Bid Price

The total of bid prices in the Schedule of Prices shall be entered in the Summary of Bid Prices.

VOLUME-III
BILL OF QUANTITIES

SEPERATELY BOUNDED

SCHEDULE -B TO BID

SPECIFIC WORKS DATA

Construction of Main Electrical Sub-Station, Complete Civil & Electrical Works, Including Sub-Station Equipment's.

Contract No.

SCHEDULE – C TO BID**WORKS TO BE PERFORMED BY SUBCONTRACTORS**

The bidder will do the work with his own forces except the work listed below which he intends to sub-contract.

Items of Works To be Sub-Contracted	Name and address of Sub-Contractors	Statement of similar works previously executed. (<i>attach evidence</i>)
---	--	--

Note:

- 1 No change of Sub-Contractors shall be made by the bidder without prior approval of the Procuring Agency.
- 2 The truthfulness and accuracy of the statement as to the experience of Sub-Contractors is guaranteed by the bidder. The Procuring Agency's judgment shall be final as to the evaluation of the experience of Sub-Contractors submitted by the bidder.
- 3 Statement of similar works shall include description, location & value of works, year completed and name & address of the clients.

SCHEDULE – D TO BID

PROPOSED PROGRAMME OF WORKS

Bidder shall provide a programme in a bar-chart or Program Evaluation and Review Technique (PERT) or Critical Path Method (CPM) showing the sequence of work items by which he proposes to complete the works of the entire Contract. The programme should indicate the sequence of work items and the period of time during which he proposes to complete the works including the activities like designing, schedule of submittal of drawings, ordering and procurement of materials, manufacturing, delivering, construction of civil works, erection, testing and commissioning of works to be supplied under the Contract.

SCHEDULE – E TO BID

METHOD OF PERFORMING WORKS

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

- The sequence and methods in which he proposes to carry out the Works, including the number of shifts per day and hours per shift, he expects to work.
- A list of all major items of construction and plant erection, tools and vehicles proposed to be used in delivering/carrying out the works at site.
- The procedure for installation of equipment and transportation of equipment and materials to the site.
- Organisation chart indicating head office & field office personnel involved in management, supervision and engineering of the Works to be done under the Contract.

SCHEDULE – F TO BID

(INTEGRITY PACT)

**DECLARATION OF FEES, COMMISSION AND BROKERAGE ETC
PAYABLE BY CONTRACTORS**

(FOR CONTRACTS WORTH RS. 10.00 MILLION OR MORE)

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

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

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

[name of Contractor] accepts full responsibility and strict liability 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 PA 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 PA under any law, contract or other instrument, be voidable at the option of PA.

Notwithstanding any rights and remedies exercised by PA in this regard, [name of Supplier/Contractor/Consultant] agrees to indemnify PA for any loss or damage incurred by it on account of its corrupt business practices and further pay compensation to PA in an amount equivalent to ten times 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 PA.

.....
 [Procuring Agency]

.....
 [Contractor]

CONDITIONS OF CONTRACT

TABLE OF CONTENTS**CONDITIONS OF CONTRACT**

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CONDITIONS OF CONTRACT

1. GENERAL PROVISIONS

1.1 Definitions

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

The Contract

1.1.1 "Contract" means the Contract Agreement and the other documents listed in the Contract Data.

1.1.2 "Specifications" means the document as listed in the Contract Data, including Procuring Agency's requirements in respect of design to be carried out by the Contractor (if any), and any Variation to such document.

1.1.3 "Drawings" means the Procuring Agency's drawings of the Works as listed in the Contract Data, and any Variation to such drawings.

Persons

1.1.4 "Procuring Agency" means the person named in the Contract Data and the legal successors in title to this person, but not (except with the consent of the Contractor) any assignee.

1.1.5 "Contractor" means the person named in the Contract Data and the legal successors in title to this person, but not (except with the consent of the Procuring Agency) any assignee.

1.1.6 "Party" means either the Procuring Agency or the Contractor.

Dates, Times and Periods

1.1.7 "Commencement Date" means the date fourteen (14) days after the date the Contract comes into effect or any other date named in the Contract Data.

1.1.8 "Day" means a calendar day

1.1.9 "Time for Completion" means the time for completing the Works as stated in the Contract Data (or as extended under Sub-Clause 7.3), calculated from the Commencement Date.

Money and Payments

1.1.10 "Cost" means all expenditure properly incurred (or to be incurred) by the

Contractor, whether on or off the Site, including overheads and similar charges but does not include any allowance for profit.

Other Definitions

1.1.11 "Contractor's Equipment" means all machinery, apparatus and other things required for the execution of the Works but does not include Materials or Plant intended to form part of the Works.

1.1.12 "Country" means the Islamic Republic of Pakistan.

1.1.13 "Procuring Agency's Risks" means those matters listed in Sub-Clause 6.1.

1.1.14 "Force Majeure" means an event or circumstance which makes performance of a Party's obligations illegal or impracticable and which is beyond that Party's reasonable control.

1.1.15 "Materials" means things of all kinds (other than Plant) to be supplied and incorporated in the Works by the Contractor.

1.1.16 "Plant" means the machinery and apparatus intended to form or forming part of the Works.

1.1.17 "Site" means the places provided by the Procuring Agency where the Works are to be executed, and any other places specified in the Contract as forming part of the Site.

1.1.18 "Variation" means a change which is instructed by the Engineer/Procuring Agency under Sub-Clause 10.1.

1.1.19 "Works" means any or all the works whether Supply, Installation, Construction etc. and design (if any) to be performed by the Contractor including temporary works and any variation thereof.

1.1.20 "Engineer" means the person notified by the Procuring Agency to act as Engineer for the purpose of the Contract and named as such in Contract Data.

1.2 Interpretation

Words importing persons or parties shall include firms and organisations. Words importing singular or one gender shall include plural or the other gender where the context requires.

1.3 Priority of Documents

The documents forming the Contract are to be taken as mutually explanatory of one another. If an ambiguity or discrepancy is found in the documents, the priority of the documents shall be in accordance

with the order as listed in the Contract Data.

1.4 **Law**

The law of the Contract is the relevant Law of Islamic Republic of Pakistan.

1.5 **Communications**

All Communications related to the Contract shall be in English language.

1.6 **Statutory Obligations**

The Contractor shall comply with the Laws of Islamic Republic of Pakistan and shall give all notices and pay all fees and other charges in respect of the Works.

2. THE PROCURING AGENCY

2.1 **Provision of Site**

The Procuring Agency shall provide the Site and right of access thereto at the times stated in the Contract Data. Site Investigation Reports are those that were included in the bidding documents and are factual and interpretative reports about the surface and subsurface conditions at the Site.

2.2 **Permits etc.**

The Procuring Agency shall, if requested by the Contractor, assist him in applying for permits, licenses or approvals which are required for the Works.

2.3 **Engineer's/Procuring Agency's Instructions**

The Contractor shall comply with all instructions given by the Procuring Agency or the Engineer, if notified by the Procuring Agency, in respect of the Works including the suspension of all or part of the works.

2.4 **Approvals**

No approval or consent or absence of comment by the Engineer/Procuring Agency shall affect the Contractor's obligations.

3. ENGINEER'S/PROCURING AGENCY'S REPRESENTATIVES

3.1 Authorised Person

The Procuring Agency shall appoint a duly authorized person to act for him and on his behalf for the purposes of this Contract. Such authorized person shall be duly identified in the Contract Data or otherwise notified in writing to the Contractor as soon as he is so appointed. In either case the Procuring Agency shall notify the Contractor, in writing, the precise scope of the authority of such authorized person at the time of his appointment.

3.2 Engineer's/Procuring Agency's Representative

The name and address of Engineer's/Procuring Agency's Representative is given in Contract Data. However the Contractor shall be notified by the Engineer/Procuring Agency, the delegated duties and authority before the Commencement of works.

4. THE CONTRACTOR

4.1 General Obligations

The Contractor shall carry out the works properly and in accordance with the Contract. The Contractor shall provide all supervision, labour, Materials, Plant and Contractor's Equipment which may be required

4.2 Contractor's Representative

The Contractor shall appoint a representative at site on full time basis to supervise the execution of work and to receive instructions on behalf of the Contractor but only after obtaining the consent of the Procuring Agency for such appointment which consent shall not be withheld without plausible reason(s) by the Procuring Agency. Such authorized representative may be substituted/ replaced by the Contractor at any time during the Contract Period but only after obtaining the consent of the Procuring Agency as aforesaid.

4.3 Subcontracting

The Contractor shall not subcontract the whole of the works. The Contractor shall not subcontract any part of the works without the consent of the Procuring Agency.

4.4 Performance Security

The Contractor shall furnish to the Procuring Agency within fourteen (14) days after receipt of Letter of Acceptance a Performance Security at the option of the bidder, in the form of Payee's order /Bank Draft or Bank Guarantee from scheduled bank for the amount and validity specified in Contract Data.

5. DESIGN BY CONTRACTOR

5.1 Contractor's Design

The Contractor shall carry out design to the extent specified, as referred to in the Contract Data. The Contractor shall promptly submit to the Engineer/Procuring Agency all designs prepared by him, within fourteen (14) days of receipt the Engineer/Procuring Agency shall notify any comments or, if the design submitted is not in accordance with the Contract, shall reject it stating the reasons. The Contractor shall not construct any element of the works designed by him within fourteen (14) days after the design has been submitted to the Engineer/Procuring Agency or which has been rejected. Design that has been rejected shall be promptly amended and resubmitted. The Contractor shall resubmit all designs commented on taking these comments into account as necessary.

5.2 Responsibility for Design

The Contractor shall remain responsible for his bided design and the design under this Clause, both of which shall be fit for the intended purposes defined in the Contract and he shall also remain responsible for any infringement of any patent or copyright in respect of the same. The Engineer/Procuring Agency shall be responsible for the Specifications and Drawings.

6. PROCURING AGENCY'S RISKS

6.1 The Procuring Agency's Risks

The Procuring Agency's Risks are:-

- a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies, within the Country;
- b) rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war, within the Country;
- c) riot, commotion or disorder by persons other than the Contractor's personnel and other employees including the personnel and employees of Sub-Contractors, affecting the Site and/or the Works;
- d) 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 of such an assembly, except to the extent to which the Contractor/Sub-Contractors may be responsible for the use of any radio-active material;

- e) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds;
- f) use or occupation by the Procuring Agency of any part of the Works, except as may be specified in the Contract;
- g) late handing over of sites, anomalies in drawings, late delivery of designs and drawings of any part of the Works by the Procuring Agency's personnel or by others for whom the Procuring Agency is responsible;
- h) a suspension under Sub-Clause 2.3 unless it is attributable to the Contractor's failure; and
- i) physical obstructions or physical conditions other than climatic conditions, encountered on the Site during the performance of the Works, for which the Contractor immediately notified to the Procuring Agency and accepted by the Procuring Agency.

7. TIME FOR COMPLETION

7.1 Execution of the Works

The Contractor shall commence the Works on the Commencement Date and shall proceed expeditiously and without delay and shall complete the Works, subject to Sub-Clause 7.3 below, within the Time for Completion.

7.2 Programme

Within the time stated in the Contract Data, the Contractor shall submit to the Engineer/Procuring Agency a programme for the Works in the form stated in the Contract Data.

7.3 Extension of Time

The Contractor shall, within such time as may be reasonable under the circumstances, notify the Procuring Agency/Engineer of any event(s) falling within the scope of Sub-Clause 6.1 or 10.3 of these Conditions of Contract and request the Procuring Agency/Engineer for a reasonable extension in the time for the completion of works. Subject to the aforesaid, the Procuring Agency/Engineer shall determine such reasonable extension in the time for the completion of works as may be justified in the light of the details/particulars supplied by the Contractor in connection with the such determination by the Procuring Agency/Engineer within such period as may be prescribed by the Procuring Agency/Engineer for the same; and the Procuring Agency may extend the time for completion as determined.

7.4 Late Completion

If the Contractor fails to complete the Works within the Time for Completion, the Contractor's only liability to the Procuring Agency for such failure shall be to pay the amount as liquidity damages stated in the Contract Data for each day for which he fails to complete the Works.

8. TAKING-OVER

8.1 Completion

The Contractor may notify the Engineer/Procuring Agency when he considers that the Works are complete.

8.2 Taking-Over Notice

Within fourteen (14) days of the receipt of the said notice of completion from the Contractor the Procuring Agency/Engineer shall either takeover the completed works and issue a Certificate of Completion to that effect or shall notify the Contractor his reasons for not taking-over the works. While issuing the Certificate of Completion as aforesaid, the Procuring Agency/Engineer may identify any outstanding items of work which the Contractor shall undertake during the Maintenance Period.

9. REMEDYING DEFECTS

9.1 Remedying Defects

The Contractor shall for a period stated in the Contract Data from the date of issue of the Certificate of Completion carry out, at no cost to the Procuring Agency, repair and rectification work which is necessitated by the earlier execution of poor quality of work or use of below specifications material in the execution of Works and which is so identified by the Procuring Agency/Engineer in writing within the said period. Upon expiry of the said period, and subject to the Contractor's faithfully performing his aforesaid obligations, the Procuring Agency/Engineer shall issue a Maintenance Certificate whereupon all obligations of the Contractor under this Contract shall come to an end.

Failure to remedy any such defects or complete outstanding work within a reasonable time shall entitle the Procuring Agency to carry out all necessary works at the Contractor's cost. However, the cost of remedying defects not attributable to the Contractor shall be valued as a Variation.

9.2 Uncovering and Testing

The Engineer/Procuring Agency may give instruction as to the uncovering and/or testing of any work. Unless as a result of an uncovering and/or testing it is established that the Contractor's design, materials, plant or workmanship are not in accordance with the Contract, the Contractor shall be paid for such uncovering and/or testing as a Variation in

accordance with Sub-Clause 10.2.

10. VARIATIONS AND CLAIMS

10.1 Right to Vary

The Procuring Agency/Engineer may issue Variation Order(s) in writing. Where for any reason it has not been possible for the Procuring Agency/Engineer to issue such Variations Order(s), the Contractor may confirm any verbal orders given by the Procuring Agency/Engineer in writing and if the same are not refuted/denied by the Procuring Agency/Engineer within ten (10) days of the receipt of such confirmation the same shall be deemed to be a Variation Orders for the purposes of this Sub-Clause.

10.2 Valuation of Variations

Variations shall be valued as follows:

- a) at a lump sum price agreed between the Parties, or
- b) where appropriate, at rates in the Contract, or
- c) in the absence of appropriate rates, the rates in the Contract shall be used as the basis for valuation, or failing which
- d) at appropriate new rates, as may be agreed or which the Engineer/Procuring Agency considers appropriate, or
- e) if the Engineer/Procuring Agency so instructs, at day work rates set out in the Contract Data for which the Contractor shall keep records of hours of labour and Contractor's Equipment, and of Materials, used.

10.3 Changes in the Quantities.

- a) If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item by more than 25 percent, provided the change exceeds 1 percent of the Initial Contract Price, the Procuring Agency/Engineer shall adjust the rate to allow for the change and will be valued as per sub clause 10.2.
- b) The Engineer shall not adjust rates from changes in quantities if thereby the Initial Contract Price is exceeded by more than 15 percent, except with the prior approval of the Procuring Agency.
- c) If requested by the Engineer, the contractor shall provide the Engineer with a detailed cost breakdown of any rate in the Bill of Quantities.

10.4 Early Warning

The Contractor shall notify the Engineer/Procuring Agency in writing as soon as he is aware of any circumstance which may delay or disrupt the Works, or which may give rise to a claim for additional payment.

To the extent of the Contractor's failure to notify, which results to the Engineer/Procuring Agency being unable to keep all relevant records or not taking steps to minimise any delay, disruption, or Cost, or the value of any Variation, the Contractor's entitlement to extension of the Time for Completion or additional payment shall be reduced/rejected.

10.5 **Valuation of Claims**

If the Contractor incurs Cost as a result of any of the Procuring Agency's Risks, the Contractor shall be entitled to the amount of such Cost. If as a result of any Procuring Agency's Risk, it is necessary to change the Works, this shall be dealt with as a Variation subject to Contractor's notification for intention of claim to the

Engineer/Procuring Agency within fourteen (14) days of the occurrence of cause.

10.6 **Variation and Claim Procedure**

The Contractor shall submit to the Engineer/Procuring Agency an itemised detailed breakdown of the value of variations and claims within twenty eight (28) days of the instruction or of the event giving rise to the claim. The Engineer/Procuring Agency shall check and if possible agree the value. In the absence of agreement, the Procuring Agency shall determine the value.

11. **CONTRACT PRICE AND PAYMENT**

11.1 (a) **Terms of Payments**

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 11.3, be paid by the Procuring Agency to the Contractor within 30 days after such Interim Payment Certificate has been jointly verified by Procuring Agency and Contractor, or, in the case of the Final Certificate referred to in Sub Clause 11.5, within 60days after such Final Payment Certificate has been jointly verified by Procuring Agency and Contractor;

Provided that the Interim Payment shall be caused in thirty (30) days and Final Payment in 60 days in case of foreign funded project. In the event of the failure of the Procuring Agency to make payment within 90 days then Procuring Agency shall pay to the Contractor compensation at the 28 days rate of KIBOR+2% per annum in local currency and LIBOR+1% for foreign currency, upon all sums unpaid from the date by which the same should have been paid.

(b) Valuation of the Works

The Works shall be valued as provided for in the Contract Data, subject to Clause 10.

11.2 Monthly Statements

The Contractor shall be entitled to be paid at monthly intervals:

- a) the value of the Works executed less to the cumulative amount paid previously; and
- b) value of secured advance on the materials and valuation of variations (if any).

The Contractor shall submit each month to the Engineer/Procuring Agency a statement showing the amounts to which he considers himself entitled.

11.3 Interim Payments

Within a period not exceeding seven (07) days from the date of submission of a statement for interim payment by the Contractor, the Engineer shall verify the same and within a period not exceeding thirty (30/60) days from the said date of submission by the Contractor, the Procuring Agency shall pay to the Contractor the sum subject to adjustment for deduction of the advance payments and retention money.

11.4 Retention

Retention money shall be paid by the Procuring Agency to the Contractor within fourteen (14) days after either the expiry of the period stated in the Contract Data, or the remedying of notified defects, or the completion of outstanding work, all as referred to in Sub-Clause 9.1, whichever is the later.

11.5 Final Payment

Within twenty one (21) days from the date of issuance of the Maintenance Certificate the Contractor shall submit a final account to the Engineer to verify and the Engineer shall verify the same within fourteen (14) days from the date of submission and forward the same to the Procuring Agency together with any documentation reasonably required to enable the Procuring Agency to ascertain the final contract value.

Within sixty (60) days from the date of receipt of the verified final account from the Engineer, the Procuring Agency shall pay to the Contractor any amount due to the Contractor. While making such payment the Procuring Agency may, for reasons to be given to the Contractor in

writing, withhold any part or parts of the verified amount.

11.6 **Currency**

Payment shall be in the currency stated in the Contract Data.

12. **DEFAULT**

12.1 **Defaults by Contractor**

If the Contractor abandons the Works, refuses or fails to comply with a valid instruction of the Engineer/Procuring Agency or fails to proceed expeditiously and without delay, or is, despite a written complaint, in breach of the Contract, the Procuring Agency may give notice referring to this Sub-Clause and stating the default. If the Contractor has not taken all practicable steps to remedy the default within fourteen (14) days after receipt of the Procuring Agency's notice, the Procuring Agency may by a second notice given within a further twenty one (21) days, terminate the Contract. The Contractor shall then demobilize from the Site leaving behind any Contractor's Equipment which the Procuring Agency instructs, in the second notice, to be used for the completion of the Works at the risk and cost of the Contractor.

12.2 **Defaults by Procuring Agency**

If the Procuring Agency fails to pay in accordance with the Contract, or is, despite a written complaint, in breach of the Contract, the Contractor may give notice referring to this Sub-Clause and stating the default. If the default is not remedied within fourteen (14) days after the Procuring Agency's receipt of this notice, the Contractor may suspend the execution of all or parts of the Works.

If the default is not remedied within twenty eight (28) days after the Procuring Agency's receipt of the Contractor's notice, the Contractor may by a second notice given within a further twenty one (21) days, terminate the Contract. The Contractor shall then demobilize from the Site.

12.3 **Insolvency**

If a Party is declared insolvent under any applicable law, the other Party may by notice terminate the Contract immediately. The Contractor shall then demobilize from the site leaving behind, in the case of the Contractor's insolvency, any Contractor's Equipment which the Procuring Agency instructs in the notice is to be used for the completion of the Works.

12.4 Payment upon Termination

After termination, the Contractor shall be entitled to payment of the unpaid balance of the value of the works executed and of the Materials and Plant reasonably delivered to the site, adjusted by the following:

- a) any sums to which the Contractor is entitled under Sub-Clause 10.4,
- b) any sums to which the Procuring Agency is entitled,
- c) if the Procuring Agency has terminated under Sub-Clause 12.1 or 12.3, the Procuring Agency shall be entitled to a sum equivalent to twenty percent (20%) of the value of parts of the Works not executed at the date of the termination, and
- d) if the Contractor has terminated under Sub-Clause 12.2 or 12.3, the Contractor shall be entitled to the cost of his demobilisation together with a sum equivalent to ten percent (10%) of the value of parts of the works not executed at the date of termination.

The net balance due shall be paid or repaid within twenty eight (28) days of the notice of termination.

13. RISKS AND RESPONSIBILITIES

13.1 Contractor's Care of the Works

Subject to Sub-Clause 9.1, the Contractor shall take full responsibility for the care of the Works from the Commencement Date until the date of the Procuring Agency's/Engineer's issuance of Certificate of Completion under Sub-Clause 8.2. Responsibility shall then pass to the Procuring Agency. If any loss or damage happens to the Works during the above period, the Contractor shall rectify such loss or damage so that the Works conform with the Contract.

Unless the loss or damage happens as a result of any of the Procuring Agency's Risks, the Contractor shall indemnify the Procuring Agency, or his agents against all claims loss, damage and expense arising out of the Works.

13.2 Force Majeure

If Force Majeure occurs, the Contractor shall notify the Engineer/Procuring Agency immediately. If necessary, the Contractor may suspend the execution of the Works and, to the extent agreed with the Procuring Agency demobilize the Contractor's Equipment.

If the event continues for a period of eighty four (84) days, either Party may then give notice of termination which shall take effect twenty eight (28) days after the giving of the notice.

After termination, the Contractor shall be entitled to payment of the unpaid balance of the value of the Works executed and of the Materials and Plant reasonably delivered to the Site, adjusted by the following:

- a) any sums to which the Contractor is entitled under Sub-Clause 10.4,
- b) the cost of his demobilization, and
- c) less any sums to which the Procuring Agency is entitled.

The net balance due shall be paid or repaid within thirty five (35) days of the notice of termination.

14. INSURANCE

14.1 Arrangements

The Contractor shall, prior to commencing the Works, effect insurances of the types, in the amounts and naming as insured the persons stipulated in the Contract Data except for items (a) to (e) and (i) of the Procuring Agency's Risks under Sub-Clause 6.1. The policies shall be issued by insurers and in terms approved by the Procuring Agency. The Contractor shall provide the Engineer/Procuring Agency with evidence that any required policy is in force and that the premiums have been paid.

- 14.2 Default If the Contractor fails to effect or keep in force any of the insurances referred to in the previous Sub-Clause, or fails to provide satisfactory evidence, policies or receipts, the Procuring Agency may, without prejudice to any other right or remedy, effect insurance for the cover relevant to such as a default and pay the premiums due and recover the same plus a sum in percentage given in Contractor Data from any other amounts due to the Contractor.

15. RESOLUTION OF DISPUTES

15.1 Engineer's Decision

If a dispute of any kind whatsoever arises between the Procuring Agency and the Contractor in connection with the works, 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 twenty eight (28) days after the day on which he received such reference, the Engineer shall give notice of his decision to the Procuring Agency (Superintending Engineer) and the Contractor.

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

15.2 Notice of Dissatisfaction

If a Party is dissatisfied with the decision of the Engineer of consultant or if no decision is given within the time set out in Sub-Clause 15.1 here above, the Party may give notice of dissatisfaction referring to this Sub-Clause within fourteen (14) days of receipt of the decision or the expiry of the time for the decision. If no notice of dissatisfaction is given within the specified time, the decision shall be final and binding on the Parties. If notice of dissatisfaction is given within the specified time, the decision shall be binding on the Parties who shall give effect to it without delay unless and until the decision of the Engineer is revised by an arbitrator.

If a contractor is dissatisfied with the decision of the Engineer of the department or decision is not given in time then he can approach Superintending Engineer within 14 days, in case of dissatisfaction with decision of Superintending Engineer or not decided within 28 days, then arbitration process would be adopted as per clause 15.3.

15.3 Arbitration

A dispute which has been the subject of a notice of dissatisfaction shall be finally settled as per provisions of Arbitration Act 1940 (Act No. X of 1940) and Rules made there under and any statutory modifications thereto. Any hearing shall be held at the place specified in the Contract Data and in the language referred to in Sub-Clause 1.5.

16 INTEGRITY PACT

16.1 If the Contractor or any of his Sub-Contractors, agents or servants is found to have violated or involved in violation of the Integrity Pact signed by the Contractor as Schedule-F to his Bid, then the Procuring Agency shall be entitled to:

- (a) recover from the Contractor an amount equivalent to ten times the sum of any commission, gratification, bribe, finder's fee or kickback given by the Contractor or any of his Sub-Contractors, agents or servants;
- (b) terminate the Contract; and
- (c) recover from the Contractor any loss or damage to the Procuring Agency as a result of such termination or of any other corrupt business practices of the Contractor or any of his Sub-Contractors, agents or servants.

On termination of the Contract under Sub-Para (b) of this Sub-Clause, the Contractor shall demobilize from the site leaving behind Contractor's Equipment which the Procuring Agency instructs, in the termination notice, to be used for the completion of the works at the risk and cost of the Contractor. Payment upon such termination shall be made under Sub-Clause 12.4, in accordance with Sub-Para (c) thereof, after having

deducted the amounts due to the Procuring Agency under Sub-Para (a) and (c) of this Sub-Clause.

CONTRACT DATA

Sub-Clauses of Conditions of Contract

1.1.3 Procuring Agency's Drawings,
(Attached with this document)

1.1.4 **The Procuring Agency means**

Project Office, KSEZ
Khairpur Special Economic Zone, Khairpur District Council Office,
Near Radio Pakistan Office old National Highway, District Khairpur
Phone: 0243-9280398-400, 554449
Fax: 0234-9280396

1.1.5 **The Contractor means**

1.1.7 **Commencement Date** means the date of issue of Engineer's Notice to Commence which shall be issued within fourteen (14) days of the signing of the Contract Agreement.

1.1.9 **Time for Completion** 180 days (6 months)

1.1.20 **Engineer:** EA Consulting Pvt. Limited.

1.3 **Documents forming the Contract listed in the order of priority:**

- (a) The Contract Agreement (if completed)
- (b) Letter of Acceptance
- (c) The completed Form of Bid
- (d) Contract Data
- (e) Conditions of Contract
- (f) The completed Schedules to Bid including Schedule of Prices
- (g) The Drawings, if any
- (h) The Specifications
- (i) Any other document forming part of the contract

2.1 **Provision of Site:** On the Commencement Date

3.1 **Authorized person:** Chief Executive Officer, Nip

3.2 **Name and address of Engineer's/Procuring Agency's representative**

Engineer's Representatives: To be notified

Procuring Agency's Representative:

Project Manager,
National Industrial Parks
Development and
Management
Company

Add following Clause 3.3

3.3 Engineer's/Employer's Facilities

a) Vehicles

The Contractor shall provide, maintain and make available at all times for the exclusive use of the Employer the following new vehicles on rental basis, the number and type of each being as specified below:

- i. Suzuki Cultus ---1 no (Maximum Fuel = 450 lit/month)

The vehicle shall be air-conditioned and fitted with 3-point inertia-reel seat belts for all occupants.

The vehicle shall be provided for the Engineer's use within 14 days from the Commencement Date.

If the Contractor fails to provide the vehicles within the time specified the cost incurred by the Engineer/Employer in renting / purchase respectively of similar vehicles plus a 20% (twenty percent) overhead charge shall be payable by the Contractor.

The vehicle shall be registered, taxed, comprehensively insured, fuelled, repaired, serviced, cleaned and maintained by the Contractor for the duration of the Contract and temporarily replaced if, in the Engineer's opinion, any vehicle is not in a roadworthy / running condition.

The Contractor shall provide safe, experienced and competent driver for the vehicle (if required by the Employer), to the approval of the Engineer. The driver shall be responsible for the vehicle allocated for the duration of the Contract. The Contractor shall promptly replace the driver who, in the Engineer's opinion, is not working satisfactorily.

4.3 **Subcontracting:** Not allowed.

4.4 **Performance Security:**

Amount: 5% of the Contract Price named in the Letter of Acceptance

Validity: The performance security shall be valid until a date 90 days from the date of issue of the Maintenance Certificate

5.1 **Requirements for Contractor's design (if any):** Not applicable

7.2 **Programme:**

Time for submission: Within seven (07) days of the Commencement Date.

Form of programme: Bar Chart

7.4 Amount payable due to failure to complete shall be 0.1% per day up to a maximum of (10%) of sum stated in the Letter of Acceptance. In addition to the Liquidated Damages, the Contractor shall borne all the cost/expenses related to the supervision of the works by the Engineer and his staff covering salaries of the Engineer and all of his Site Supervision staff including all the benefits, providing, running and maintenance of all the Engineer's Facilities up to the issuance of the Taking Over Certificate

by the Employer. All the above cost/expanses will not be reimbursed / paid to the Contractor beyond the approved completion period of the works.

Completion of Works:

Completion period as per NIT.

7.5 Early Completion

Not Applicable

9.1 Period for remedying defects: 365 days

10.2 (e) Variation Procedures:

The Contractor shall submit with his bid, the Day work rates of Plant & Equipment and manpower

10.6 Variation and Claim Procedures:

Add following at the end of Clause 10.6

The Contractor shall not be entitled for any payment in respect of the claim(s) if the Contractor fails to comply with the requirements of time period stipulated in this Clause 10.6 and or fails in keeping and producing necessary records of claim whenever demanded by the Engineer.

11.1 Terms of Payments

a) Mobilization Advance

- (1) Mobilization Advance up to 10 % of the Contract Price stated in the Letter of Acceptance shall be paid by the Procuring Agency to the Contractor on the works costing Rs.2.5 million or above on following conditions:
 - (i) On submission by the Contractor of a Mobilization Advance Guarantee for the full amount of the Advance in the specified form from a Scheduled Bank in Pakistan to the Procuring Agency;
 - (ii) Contractor will pay interest on the mobilization advance at the rate of 10% per annum on the advance; and
 - (iii) This Advance including the interest shall be recovered in 5 equal installments from the five (05) R.A bills and in case the number of bills is less than five (05) then 1/5 of the advance inclusive of the interest thereon shall be recovered from each bill and the balance together with

interest be recovered from the final bill. It may be insured that there is sufficient amount in the final bill to enable recovery of the Mobilization Advance.

OR

2) **Secured Advance on Materials**

- (a) The Contractor shall be entitled to receive from the Procuring Agency Secured Advance against an INDENTURE BOND in P W Account Form No. 31(Fin. R. Form No. 2 acceptable to the Procuring Agency of such sum as the Engineer may consider proper in respect of non-perishable materials **(only in steel reinforcement bars)** brought at the Site but not yet incorporated in the Permanent Works provided that:
- (i) The materials are in accordance with the Specifications for the Permanent Works;
 - (ii) Such materials have been delivered to the Site and are properly stored and protected against loss or damage or deterioration to the satisfaction and verification of the Engineer but at the risk and cost of the Contractor;
 - (iii) The Contractor's records of the requirements, orders, receipts and use of materials are kept in a form approved by the Engineer, and such records shall be available for inspection by the Engineer;
 - (iv) The Contractor shall submit with his monthly statement the estimated value of the materials on Site together with such documents as may be required by the Engineer for the purpose of valuation of materials and providing evidence of ownership and payment therefore;
 - (v) Ownership of such materials shall be deemed to vest in the Procuring Agency and these materials shall not be removed from the Site or otherwise disposed of without written permission of the Procuring Agency;
 - (vi) The sum payable for such materials on Site shall not exceed 75% of the (i) landed cost of imported materials, or (ii) ex-factory / ex-warehouse price of locally manufactured or produced materials, or (iii) market price of stands other materials;
 - (vii) Secured Advance should not be allowed unless & until the previous advance, if any, fully recovered;
 - (viii) Detailed account of advances must be kept in part II of running account bill; and
 - (ix) Secured Advance may be permitted only against

materials/quantities anticipated to be consumed / utilized on the work within a period of 3 months from the date of issue of secured advance and definitely not for full quantities of materials for the entire work/contract

(b) Recovery of Secured Advance:

- (i) Secured Advance paid to the Contractor under the above provisions shall be effected from the monthly payments on actual consumption basis, but not later than period specified in the rules not more than three months (even if unutilized); other conditions.
- (ii) As recoveries are made the outstanding accounts of the items concerned in Part II should be reduced by making deduction entries in the column "deduct quantity utilized in work measured since previous bill," equivalent to the quantities of materials used by the contractor on items of work shown as executed in part I of the bill.

(c) Interim payments: The Contractor shall submit to the Engineer monthly statements of the estimated value of the work completed less the cumulative amount certified previously.

- (i) The value of work completed comprises the value of the quantities of the items in the Bill of Quantities completed.
- (ii) value of secured advance on the materials and valuation of variations (if any).
- (iii) Engineer may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.
- (v) Retention money and other advances are to be recovered from the bill submitted by contractor.

(b) Valuation of the Works:

- i) Re-measurement with estimated/bid quantities in the Schedule of Prices

11.4 **Percentage of retention:** 10% of the amount of Interim Certificate but to a maximum of 5% of Contract Price

11.6 **Currency of payment:** Pak. Rupees

14.1 **Insurances:** from Jubilee Insurance, Adamjee Insurance or EFU Insurance Company.

Type of cover

The Works

Amount of cover

The sum stated in the Letter of Acceptance plus fifteen percent (15%)

Type of cover

Contractor's Equipment:

Amount of cover

Full replacement cost plus fifteen percent (15%)

Type of cover

Third Party-injury to persons and damage to property

The Third Party 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
- iv) in case of damage to property, full amount of repair/replacement as the case may be.

Workers:

- 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

Other cover:

Contractor's All Risk Policy

(In each case name of insured is Contractor and Procuring Agency). All Insurance policies shall be valid till issuance of Completion Certificate

14.2 Amount to be recovered

Premium plus twenty percent (20%).

14.2 Arbitration

Place of Arbitration: Karachi

STANDARD FORMS

FORM OF BID SECURITY
(Bank Guarantee)

Guarantee No. _____
Executed on _____

(Letter by the Guarantor to the Procuring Agency)

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

Name of Principal (Bidder) with address: _____

Sum of Security (express in words and figures): _____

Bid Reference No. _____ Date of Bid _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bid and at the request of the said Principal, we the Guarantor above-named are held and firmly bound unto the _____, (hereinafter called The "Procuring Agency") in the 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 Principal has submitted the accompanying Bid numbered and dated as above for _____ (Particulars of Bid) to the said Procuring Agency; and

WHEREAS, the Procuring Agency has required as a condition for considering the said Bid that the Principal furnishes a Bid Security in the above said sum to the Procuring Agency, conditioned as under:

- (1) that the Bid Security shall remain valid for a period of twenty eight (28) days beyond the period of validity of the bid;
- (2) that in the event of;
 - (a) the Principal withdraws his Bid during the period of validity of Bid, or
 - (b) the Principal does not accept the correction of his Bid Price, pursuant to Sub-Clause 16.4 (b) of Instructions to Bidders, or
 - (c) failure of the successful bidder to
 - (i) furnish the required Performance Security, in accordance with Sub-Clause IB-21.1 of Instructions to Bidders, or

- (ii) sign the proposed Contract Agreement, in accordance with Sub-Clauses IB-20.2 & 20.3 of Instructions to Bidders,

the entire sum be paid immediately to the said Procuring Agency for delayed completion and not as penalty 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 Agreement with the said Procuring Agency in accordance with his Bid as accepted and furnish within fourteen (14) days of receipt of Letter of Acceptance, a Performance Security with good and sufficient surety, as may be required, upon the form prescribed by the said Procuring Agency for the faithful performance and proper fulfilment of the said Contract or in the event of non-withdrawal of the said Bid within the time specified then this obligation shall be void and of no effect, but otherwise to remain in full force and effect.

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

PROVIDED ALSO THAT the Procuring Agency shall be the sole and final judge for deciding whether the Principal 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 Guarantor shall pay without objection the sum stated above upon first written demand from the Procuring Agency forthwith and without any reference to the Principal or any other person.

IN WITNESS WHEREOF, the above bounded Guarantor has executed the instrument under its seal on the date indicated above, the name and 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. _____

Corporate Secretary (Seal)

2. _____

(Name, Title & Address)

1. Signature _____

2. Name _____

3. Title _____

Corporate Guarantor (Seal)

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

Guarantee No. _____

Executed on _____

Expiry Date _____

(Letter by the Guarantor to the Procuring Agency)

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

Name of Principal (Contractor) with
address: _____

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

Letter of Acceptance No. _____ Dated _____

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

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

NOW THEREFORE, if the Principal (Contractor) shall well and truly perform and fulfill all the undertakings, covenants, terms and conditions of the said Documents during the original terms of the said Documents and any extensions thereof that may be granted by the Procuring Agency, with or without notice to the Guarantor, which notice is, hereby, waived and shall also well and truly perform and fulfill all the undertakings, covenants terms and conditions of the Contract and of any and all modifications of the 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 9, Remedying Defects, of Conditions of

Contract are fulfilled.

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

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

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

IN WITNESS WHEREOF, the above bounded 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 _____

1. _____

2. Name _____

 Corporate Secretary (Seal)

3. Title _____

2. _____

 (Name, Title & Address)

 Corporate Guarantor (Seal)

FORM OF CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT (hereinafter called the "Agreement") made on the ____ day of _____ 2012 ____ between _____ (hereinafter called the "Procuring Agency") of the one part and _____ (hereinafter called the "Contractor") of the other part.

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

NOW this Agreement witnesseth as follows:

- 1 In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.
2. The following documents after incorporating addenda, if any except those parts relating to Instructions to Bidders, shall be deemed to form and be read and construed as part of this Agreement, viz:
 - (a) The Letter of Acceptance;
 - (b) The completed Form of Bid along with Schedules to Bid;
 - (c) Conditions of Contract & Contract Data;
 - (d) The priced Schedule of Prices/Bill of quantities (BoQ);
 - (e) The Specifications; and
 - (f) The Drawings
- 3 In consideration of the payments to be made by the Procuring Agency to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Procuring Agency to execute and complete the Works and remedy defects therein in conformity and in all respects within the provisions of the Contract.
- 4 The Procuring Agency hereby covenants to pay the Contractor, in consideration of the execution and completion of the Works as per provisions of the Contract, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS WHEREOF the parties hereto have caused this Contract 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 the Procuring Agency

(Seal)

(Seal)

Signed, Sealed and Delivered in the presence of:

Witness:

Witness:

(Name, Title and Address)

(Name, Title and Address)

MOBILIZATION ADVANCE GUARANTEE

Guarantee o. _____
Executed on _____

(Letter by the Guarantor to the Procuring Agency)

WHEREAS the _____ (hereinafter called the Procuring Agency) has entered into a Contract for _____ (Particulars of Contract), with _____ (hereinafter called the Contractor).

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

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

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

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

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

This Guarantee shall come into force as soon as the advance payment has been credited to the account of the Contractor.

This Guarantee shall expire not later than _____ by which date we must have received any claims by registered letter, telegram, telex or telefax.

It is understood that you will return this Guarantee to us on expiry or after settlement of the total amount to be claimed hereunder.

Guarantor (Scheduled Bank)

Witness:

1. _____

Corporate Secretary (Seal)

2. _____

(Name, Title & Address)

1. Signature _____

2. Name _____

3. Title _____

Corporate Guarantor (Seal)

INDENTURE FOR SECURED ADVANCES.

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

This INDENTURE made the day of197--"-
BETWEEN (hereinafter called "the Contractor" which expression shall where the context so admits or implied be deemed to include his heirs, executors, administrators and assigns) of the one part and THE GOVERNOR OF SINDH (hereinafter called "the Government" of the other part).

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

(Here enter (the description of the works).¹

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

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

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

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

- (1) That the said sum of Rupees.....(RF. -----) so advanced by the Government to the Contractor as aforesaid and all or any further sum or sums which may be advanced aforesaid shall be employed by the contractor in or towards expending the execution of the said works and for no other purpose whatsoever.

- (2) That the materials detailed in the said Running Account Bill (B) which have been

Fin R Form No. 17-A

Offered to and accepted by (he Government as security for the said amount are absolutely by the Contractors own property free from encumbrances of any kind and the Contractor will not make any application for or receive a further advance on the security of materials which are not absolutely his own property and free from encumbrances of any kind and the contractor hereby agrees, at all times, to indemnify and save harmless the Government against all claims whatsoever to any materials in respect of which an advance has been made to him as aforesaid.

- (3) That the said materials detailed in the said Running Account Bill (B) and all other

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Materials on the security of which any further advance or advances may hereafter be made as aforesaid (hereinafter called the said materials) shall be used by the Contractor solely in the execution of the said works in accordance with the directions of the Divisional Officer-----
 ----(hereinafter called the Divisional Officer) and in the terms of the said agreement.

- (4) That the Contractor shall make at his own cost all necessary and adequate arrangement for the proper watch, safe custody and protection against all risks of the said material and that until used in construction as aforesaid the said materials shall remain at the site of the said works in the Contractor's custody and at his own risk and on his own responsibility and shall at all times be open to inspection by (he Divisional Officer or any officer authorized by him. In the event of the said materials of any part (hereof being stolen, destroyed or damaged or becoming deteriorated in a greater degree than is due to reasonable use and wear thereof Contractor will forthwith replace the same with other materials of like quality or repair and make good the same as required by the Divisional Officer and the materials so brought to replace the said materials so repaired and made good shall also be considered as security for the said amount.
- (5) 'Hurt the said materials shall not on any account be removed from the site of the said works except with the written permission of the Divisional Officer or an officer authorized by him in that behalf
- (6) That the said amount shall be payable in full when or before the Contractor receives payment, from the Government of the price payable to him for the said works under the terms and provisions of the said agreement PROVIDED THAT if any intermediate payments are made to the contractor on account of work done then on the occasion of each such payment the Government will be at liberty to make a recovery from the Contractors Bill for such payment by deducting there from in the value of the said materials (hen actually used in the

construction and in respect of which recovery has not been made previously the value for this purpose being determined in respect of each description of material at (he rates at which the amount of the advances made under these presents were calculated.

- (7) That if the Contractor shall at any time make any default in the performance or observation in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances that may still be owing to the Government shall immediately on the happening of such default be repayable by the Contractor to the Government together with interest thereon at twelve percent per annum from the date or respective dates of such advance or advances to the date or repayment and with all costs, charges, damages and expenses incurred by the Government in or for the recovery thereof or the enforcement of this security or otherwise by reason of (he default of the Contractor and any moneys so becoming due and payable shall constitute a debt due from the Contractor to the Government and the Contractor hereby covenants and agrees with the Government to repay and the same respectively to it accordingly.
- (8) That the Contractor hereby charges all the said materials with the repayment to the Government of the said sum of Rupees (Rs.....) and any further sum or sums which may be advanced as aforesaid and all costs charges damages and expenses payable under these present PROVIDED ALWAYS and it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the powers contained therein if and whether the covenant for payment and repayment hereinbefore contained shall become enforceable and the money owing shall not be paid to accordingly.

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

- (a) Seize and utilize the said materials or any part thereof in the completion of the said works on behalf of the Contractor in accordance with the provisions in that behalf contained in the said agreement debiting the Contractor with the actual cost of effecting such completion the amount due in respect of advances under these presents and crediting the Contractor with the value of work done as he had carried it out in accordance with the said agreement and at the rates thereby provided. If the balance is against the Contractor he is to pay the same to the Government on demand.
- (b) Remove and sell by public auction the seized materials or any part thereof and out of the moneys arising from the sale retain all the sums aforesaid repayable to the Government under these presents and pay over the surplus (if any) to the Contractor.

- (c) Deduct all or any part of the moneys owing out of the security deposit or any sum due to the Contractor under the said agreement.
- (9) That except as is expressly provided by the presents interest on the aid advance shall not be payable.
- (10) That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been hereinbefore expressly provided for the same shall be referred to the Superintending Engineer..... Circle whose..... decision shall be final and the provisions of the Indian Arbitration Act for the time being in force so far as they are applicable shall apply to any such reference.

In witnesses whereof the on behalf of the Governor of Sindh and the said..... have hereunto set their respective hands and seals the day and first above written.

Signed, sealed and delivered by in the presence of

Seal
1st witness 2nd witness

Signed, sealed and delivered by in the presence of

Seal
1st Witness 2nd witness

VOLUME-II SPECIFICATION

CIVIL WORKS

**PROJECT OFFICE, KHAIRPUR SPECIAL ECONOMIC ZONE
(KSEZ) DISTRICT KHAIRPUR**

**“ Construction of Main Substation at KSEZ”
TENDER DOCUMENTS**

(VOLUME – II)

SPECIFICATIONS FOR CIVIL WORKS

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SECTION - 1

1.0 GENERAL

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

his own cost.

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

1.13 **PAYMENT**

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

SECTION - 2

2.0 SITE CLEARING, GRUBBING AND SETTING OUT OF WORKS

2.01 SCOPE OF WORK

The work covered by this section of specifications consist of furnishing all labour, necessary equipment, services, miscellaneous and necessary items required to satisfactorily complete the clearing, grubbing and setting out of the works, as indicated on drawings, specified herein or both.

2.02 CLEARING

Clearing shall consist of cutting, or trimming of trees, if any, and the satisfactory disposal of tree and other vegetation designated for removal, together with the timber snags, bushes, and rubbish occurring within the area. Trees, other vegetation stumps, roots, and bushes in area to be cleared shall be cut off flush with or below the original ground surface except such individual trees, group of trees and vegetation as may be indicated on the drawing or designated by Engineer or his Representative to be left standing. Individual trees and other vegetation, to be left standing shall be thoroughly protected from damage during construction operation, by erection of barriers or by such other means as the circumstances require and as approved by the Engineer's Representative. Clearing operation shall be conducted in a manner that existing structures and installations under construction, employees and others remain safe.

2.03 GRUBBING

Grubbing shall consist of the removal and disposal of all stumps, roots and matted roots in the designated grubbing areas. Stumps, roots, logs and timber and other debris, shall be excavated and removed to a depth not less than 2 feet below any sub-grade level. In areas where the cut is over 3'-6" grubbing shall not be necessary.

2.04 DISPOSAL OF DEBRIS

Timber and other refuse to be disposed off by burning shall be burned at location, approved by the Engineer's Representative, in a manner that will avoid all hazard such as damage to existing structures, construction in progress, trees and vegetation. The contractor shall be responsible for compliance with all pertinent laws and regulations pertaining to the burning of fire. Disposal by burning shall be kept under constant attendance, and residual, until materials will not be permitted to be pushed or placed on the adjacent areas without written approval of the owner/owners. The stones and concrete shall be broken and removed from the site for receiving the structure/flooring where required. All debris shall be disposed off by the Contractor as directed by the Engineer.

2.05 SETTING OUT OF WORKS

The Contractor shall set out the works and shall be responsible for true and perfect setting out of the same and for correctness of the direction, levels, dimension and alignment of all parts thereof. If at any time any error in this respect shall appear during the progress of the works, the Contractor shall, at his own expense, rectify the error to the satisfaction of the Engineer. The Contractor shall construct accurate benchmarks so that the lines and levels can easily be checked by the Engineer.

2.06 DRAINAGE DITCHES

The Contractor shall construct and maintain such ditches, in addition to those shown on drawings or as may be ordered by the Engineer to adequately drain and areas under construction.

2.07 **PAYMENT**

No separate payment shall be made for the work covered in this section of the specification and all costs of site clearing and setting out shall be covered in the unit rates of the Contractor for other items.

SECTION - 3

3.0 EXCAVATION, FILLING, BACKFILLING AND DISPOSAL

3.01 SCOPE OF WORK

The work covered by this section of the Specifications consists of furnishing all Plant, Labour Equipment Appliances and materials and in performing all operations in connection with excavating, filling, backfilling and disposal for building construction, and other foundations complete in strict accordance with this section of the Specifications and the applicable drawings and subject to the terms and conditions of the Contract.

3.02 BORING LOG DATA

A preliminary report on Sub-Soil investigation and exploratory data of the site area is available for reference only in the office of the Engineer. The Employer or Engineer's predications, regarding character or extent of soil or other sub-surface conditions to be encountered during the work are not binding on the Contractor. The Contractor shall make his own deductions for sub-surface conditions which may affect methods or cost of constructions of the work hereunder and he shall make no claim whatsoever for damages or compensation, should he find conditions during the progress of the work, different from those indicated by the soil investigation report of Engineer.

3.03 EXCAVATION

(a) Classification

Excavation shall include the removal of all materials of every category and nature. If rock is encountered it shall be removed carefully and without excessive noise and vibration. Blasting shall not be resorted to without specific permission in writing from the Engineer.

(b) The excavation shall conform to the dimensions and elevations as indicated on the Drawings. Foundations on made up ground shall be taken down to natural bottom soil as per direction and approval of the Engineer. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms installation of services and for inspection but the same shall not be paid.

(c) In the event of any excavations being carried out wider or deeper than authorized, the same shall be filled in by the Contractor at his own cost to the required levels with lean concrete if below footing or with properly compacted local river sand if beneath slabs or as directed by the Engineer.

(d) Shoring and Bracing:

The Contractor shall provide at his own cost, where required all shoring walls, supports etc. to the sides of the excavation to prevent sliding or any movement. Where necessary, excavated sides shall be sloped as directed by the Engineer.

(e) Dewatering and Drainage:

The Contractor shall control the grading in the vicinity of site of work in order to prevent any water from running into the excavated areas. He shall at his

own cost keep dry all pits and trenches during construction and all de-watering and pumping out whether due to ground water seepage or otherwise, shall be included in the rates as quoted by the Contractor. The method employed in all cases shall be approved and agreed by the Engineer or his Representative.

(f) Protection of utility lines:

When any existing utility lines whether to be retained or be removed are encountered within the area of operations, the Contractor shall notify the Engineer and his Representative, and shall not proceed until necessary measures are taken for protection or removal of the lines and instructions are obtained from the Engineer.

(g) Excess and undesirable material from excavation not required for fill or backfill of the building site, shall be disposed off, removed and/or deposited as for filling and leveled anywhere on the work site as directed by the Engineer. Earth suitable and meant for backfill shall be stored at site in a manner not to interfere with the progress of construction works.

3.04 **FILL AND BACKFILL**

Where concrete slabs are to be placed on the ground, any loam, organic and other unsuitable material shall be removed. Fill where required to raise the sub-grade for concrete slabs shall be clean, unadulterated local river sand or gravel and shall be free from wood, stones and other debris. Excavated material shall only be used for fill if approved by the Engineer in writing. All the backfill behind the sub-grade walls shall be done with clean local river sand or approved excavated soil. Fill shall be compacted upto 95% modified AASHTO Density by a Power vibratory roller, mechanical rammer, or other approved equipment, in layers not more than 6 inch thick. Each layer shall be uniformly spread, watered to the extent of optimum moisture requirement for the required degree of compaction and then compacted. Contractor shall arrange at his own cost the testing of the filling where required by the Engineer or his Representative, after completion of foundation footings, walls, slabs and other construction below the elevation of the final grades and prior to backfilling. Backfill shall be placed in horizontal layers not more than 6 inches thick and shall have proper moisture content for the required degree of compaction of 95%. Each layer shall be compacted by mechanical tampers or by other suitable equipment approved by the Engineer. Backfill shall be brought to a suitable elevation above grade to provide for anticipated settlement and shrinkage thereof.

Backfill shall not be placed against foundation walls etc., prior to the damp proofing treatment, if specified and approved by the Engineer or his Representative. Backfill shall be brought up evenly on each sidewall as far as practicable. Heavy equipment for spreading and compacting backfill shall not be operated closer to the wall than distance equal to the height of the backfill above the top of footing.

3.05 **COMPACTION:**

Fill and/or backfill within the building or structures and for a distance of 6 ft. outside structures shall be compacted to a density of not less than 95% maximum density at optimum moisture content.

3.06 **ROUGH GRADING:**

(a) Necessary rough grading shall be carried out by the Contractor to establish

grade or construction requirements of the site. Grades not otherwise indicated shall be uniform levels or slopes between points on existing and finished grades. Abrupt changes in slopes shall be rounded. Additional fill required to complete rough grading shall be provided as directed by the Engineer or his Representative.

- (b) Where paving or slabs are specified, all rough grading shall be done to the sub-grade of the base course, removing all large stones and debris and shall be compacted uniform to the correct lines and levels ready to receive the paving or slab. Refilling, where required shall be executed with suitable selected materials in layers not exceeding 6 inch thick and thoroughly compacted to the required density. In place density tests shall be carried out by the Contractor for the approval of the compaction by the Engineer.

3.07 **FOOTING BOTTOM LEVELS:**

The levels as noted in the Drawings are only approximate and must be adjusted in the field with the approval of Engineer, depending on the soil conditions encountered. No concreting shall begin until the soil bearing capacity is substantiated by visual inspection by the Engineer or his Representative. The Contractor in planning his work shall make arrangement and provisions to construct the lowest level footings first.

3.08 **FIELD LEVELS:**

Prior to starting the work, the Contractor shall arrange to take the levels of the piece of land on which the building is located as directed by the Engineer. The same shall be simultaneously checked by the Engineer or his Representative and shall form the basis of payments for excavation and filling etc.

3.09 **DISPOSAL OF SURPLUS EARTH AND RUBBISH:**

All surplus earth and rubbish shall be disposed off at site as directed by the Engineer. The term disposal shall include all operations of loading, unloading, stacking, spreading, rehandling, filling in depressions, including consolidating and ramming in layers not exceeding 6 inch thickness.

3.10 **MEASUREMENTS AND PAYMENTS:**

All excavation shall be measured net and perpendicular and no allowance shall be made for any increase in bulk of the excavated material after excavation or for sloping sides, or widened trenches to accommodate formwork, shoring and bracing etc. Similarly the measurements for filling/backfilling shall be thoroughly compacted and measured net and no allowance shall be made for any increase in bulk after excavation. Excavation, filling and Disposal shall include all leads and lifts as specified elsewhere in these specifications. Payment for all the items under this section shall be made at the rates entered in the BOQ appended to the contract and in accordance with the applicable conditions of the contract.

Note:-

1. Imported earth fill item payment will be separately paid as per BOQ appended to the contract and in accordance with applicable condition of the contract.

SECTION - 4

4.0 TERMITE CONTROL

4.01 SCOPE OF WORK:

The work covered by this section of Specification consists of furnishing all labour, materials, equipment, services, miscellaneous and necessary items required to complete Termite Control work, related works as indicated on drawings specified herein or both.

4.02 MATERIALS:

- (a) Pesticides shall be solution of an approved chlorinated hydrocarbon such as 0.5% Dieldrin or 0.5% Aldrin mixed in clean water for application to or in earth, and mixed in pure turpentine for application to wood.
- (b) Pesticides (dieldrin and aldrin) shall be obtained from the Government of Pakistan, Department of Agriculture, in sealed drums at rates in force at the time of their acquisition and only in the quantity necessary for work of this Project. All mixing shall be done at site and the amount of pesticides used shall be verified by the Engineer his Representative.

4.03 METHOD OF APPLICATION:

Pesticides solution shall be applied with approved pressure spraying equipment maintaining a pressure of 1N/Sq.mm (150 lb/sq.in.) for all applications, to, on, or in earth. Spraying to wood shall be done by hand compression sprayers with an approximate pressure of 0.15 N/Sq.mm (20 lb/Sq.in).

4.04 EXTENT OF APPLICATION:

- (a) At excavation, all walls and bottoms of all pits or trenches for footings or foundations are to be sprayed. Pesticide shall penetrate to a depth of 1'-0" minimum in porous earth at bottom and 3" minimum at sides of excavations.
- (b) Stockpiled excavated material to be used as back fill is to be treated as above. After back-filling to plinth level, area of the whole building upto 10'-0" outside the building line is again to be sprayed penetrating a minimum of 1 ft. into soil.
- (c) After grading, compaction and sand filling before formation of hard core/soling under floor slabs all areas to be covered shall be sprayed with pesticides, penetrating a minimum of 1 ft. into soil.
- (d) All rough woodwork for the entire project shall be pesticide treated (before application of so lignum in the case of material to receive both treatments). Pesticide shall be sprayed on all surfaces of blocking, furring, planks, scantlings, boards etc. before installations. Spraying shall be once again done at the site, after delivery and before installation. All spraying will be done within one week of working of the material.

4.05 LOCATION AND SCHEDULING:

- (a) Saturation of earth is to be done in such a manner as to in no way disrupt the progress of work.
- (b) Spraying of rough woodwork shall be done on or near the site at location and in such enclosures as proposed by the Contractor and approved by the Engineer. Such work is to be scheduled and done by sufficient skilled personnel as to in no way impede the progress of the work.
- (c) Care shall be exercised to ensure that no marks or damage occurs to the finished building as a result of the work under this Section, and Contractor shall verify and ensure that no material used herein will impede the growth of grass or plants at areas where spraying is done.

4.06 STANDARD:

All methods of termite protections used herein shall be in accordance with the standard practices of National Pest Control Association, U.S.A, and the British Wood Preserving Association.

4.07 GUARANTEE:

The Contractor is to guarantee that the building shall be free from termite (white ants), wood bores and other pests or rodents which cause damage to wood or other organic material for 10 years from the date of acceptance of the building.

In the event of any damage caused within the guarantee period, the Contractor shall replace at his own cost such damaged material finishes affected and suitably preserve and treat the entire premises with the best method known to the trade to prevent the spreading of termites and other pests.

4.08 TESTING:

All materials and samples shall be subjected to standard testing in accordance with the standards specified herein and shall be rejected if found below these standards. Rejected materials shall be removed from the site immediately.

4.09 PAYMENT:

Payment will be made for building site which will be paid separately on the basis of plinth area covered by this treatment including all ditches, pits, excavation, fills etc. complete as per rate quoted in the Bill of Quantities.

SECTION - 5

5.0 WATER

5.01 SCOPE:

The work covered by this section of the Specification consists of furnishing all labour, appliances and in performing all operations in connection with obtaining, conveying and storing water at site of work.

5.02 QUALITY OF WATER:

The water used for construction shall be free from impurities and fit for drinking purpose.

5.03 TESTING:

Water if required, shall be subjected to standard testing at the cost of the Contractor and if found to be unsuitable for construction work then the Contractor shall take such action as directed by the Engineer.

5.04 PAYMENT:

No separate payment will be made for the work covered under this section, and all costs in connection therewith shall be deemed to be included in the unit rates.

5.05 TEMPORARY STORAGE TANK:

The Contractor shall provide on site at his own cost temporary storage water tank with all necessary G.I. Pipes and fittings as per instructions of the Engineer. No separate payment will be made for tank, pipes and accessories, etc. These tanks shall be removed or dismantled or demolished and the area shall be cleaned and made good on completion of work as per direction of Engineer.

SECTION - 6

6.0 CONCRETE

6.01 SCOPE OF WORK:

The work covered by this section of the Specifications consists of furnishing all plants, labour equipment appliances and materials and in performing all operations in connection with concrete work complete in strict accordance with the applicable Drawings and the Specifications herein and subject to the terms and conditions of the Contract.

6.02 GENERAL:

Full cooperation shall be extended to other trades to install embedding items, and form ducts and openings etc. Embedded items shall have been inspected and check tested for concrete and other materials or for mechanical operations and approved before concrete is placed.

6.03 MATERIALS:

6.03.1 CEMENT

- i) Grey/ white Portland Cement shall be normal setting cement of the specific gravity, fineness and chemical composition fully conforming to Pakistan Standard Specifications P.S. No.232:1967 and shall be capable of satisfying all tests such as the tensile strength tests contained therein. Standard test briquettes prepared with 1:3 cement sand mortar shall give the following tensile strengths:

At 3 days not less than 300 Lbs/Sq.in(2.1N/Sq.mm).

At 7 days not less than 400 Lbs/Sq.in(2.8N/Sq.mm).

- ii) Sulphate Resistant Cement where required shall be sulphate Resistant Cement type 'A' fully conforming to Pakistan Standard Specification PS No.612:1967 and satisfying the requirements for fineness, chemical composition strength, setting time and soundness, etc.
- iii) For all types of cements, described in sub-Clauses (i) and (ii) above, the average compressive strength of three concrete cubes shall not be less than 1200 Lbs/Sq.in(8.2 N/Sq.mm) at three days and not less than 2000 Lbs/Sq.in(14 N/Sq.mm) at seven days as described in Ps.No.232.1962. Alternatively, the average compressive strength of three mortar cubes prepared with 1:3 cement and standard silica sand mortar shall not be less than 2200 Lbs/Sq.in(15.2 N/Sq.mm) at three days and not less than 3400 Lbs/Sq.in(23.5 N/Sq.mm) at seven days. The initial setting time shall not be less than 45 minutes and final setting time not more than 10 hours.

- iv) The supply of cement must be so programmed by the Contractor that at no time the quantity of cement stock shall be less than that required for an average consumption of four weeks. Lorry or truck or other means of transportation, for the conveyance of cement to the site of works, shall be clean, dry, metallised lined and covered from top with water proof sheets, so that cement is sufficiently protected from any deterioration during transit.
- v) The Contractor shall provide at his own cost, on the Site, all necessary sheds, which shall be perfectly dry and watertight for the storing of cement to be delivered to the works, to ensure adequate supplies being available at site of work.
- vi) If at any time the Engineer or his Representative considers that any batch of cement may have deteriorated on the site during storage for any reason, he will direct that tests shall be made and that batch of cement on the site shall not be used until it has been shown by test at a laboratory, approved or appointed by the Engineer, to be satisfactory. Contractor shall bear all costs of such testing. Any rejected cement shall be removed from the site by the Contractor without delay. Cement reclaimed from cleaning bags or leaking containers shall not be used.
- vii) Cement shall be consumed in the sequence of receipt of shipments unless otherwise directed by the Engineer or his Representative.

6.03.2 AGGREGATES

- i) All fine and coarse aggregates to be used shall be supplied from approved sources, which shall not be changed without permission in writing from the Engineer. Aggregates shall conform to the test requirements of Pakistan Standard 243:1963 or equivalent.
- ii) Fine aggregates, shall be approved sand and shall be clean, sharp, free from clay, earth, vegetable and organic matters, alkaline or acid reactions or other deleterious matter or impurities.
- iii) Fine aggregates shall conform to Pakistan Standard Specifications PS No.243:1963 "Natural Aggregates for Concrete" and shall be graded as follows:-

B.S.SIEVE NUMBER.	PERCENTAGE (BY WEIGHT) PASSING	
	Grading Zone 1.	Grading Zone 2.
3/8"(9.5 mm)	100	100
3/16"(4.8 mm)	90 - 100	90 - 100
No. 7	60 - 95	75 - 100
No. 14	30 - 70	55 - 90
No. 25	15 - 34	35 - 59
No. 52	5 - 20	08 - 30
No.100	0- 10	00 – 10

- iv) Coarse aggregates shall be approved hard crushed stone from a source approved by the Engineer and shall be clean, free from sand, dust, salt, lime, chalk, clay and organic impurities or other deleterious matter.
- v) Coarse aggregates shall conform to the relevant Pakistan Standard Specifications PS No.243:1963 Coarse aggregate shall be graded as follows:-

FOR CONCRETE CLASSES A, B & C (Nominal Size of Graded Aggregate 3/4" to 3/16" (19 mm to 4.8 mm).

B.S.SIEVE NUMBER	PERCENTAGE (BY WEIGHT) PASSING
1" (25.4mm)	100
3/4" (19 mm)	090 - 100
3/8" (9.5mm)	020 - 55
3/16"(4.8mm)	000 - 10

FOR CONCRETE CLASSES D & E (Nominal Size of Graded Aggregate 1-1/2" to 3/16" (38 mm to 4.8 mm).

1 1/2" (38 mm)	100
1" (25.4 mm)	95 - 100
3/4" (19 mm)	35 - 70
3/8" (9.5mm)	10 - 33
3/16"(4.8mm)	0 - 5

- vi) All aggregates shall be stored on properly constructed paving and in bins and there shall be a physical partition between the stockpiles of coarse and fine aggregate. No mixed up aggregates shall be used in any concrete. Under no circumstances aggregates shall be allowed to be in contact with ground.
- vii) If required, aggregates shall be washed and screened to the satisfaction of the Engineer or his Representative before use by processing through proper screening and washing plant. Adequate time is to be allowed therefore, for the moisture content to become substantially uniform before use in works.
- viii) Sieve analysis and other necessary tests of all aggregates shall be carried out as and when required by the Engineer or his Representative. Samples for such tests shall be taken in the presence of the Engineer or his Representative. All costs in connection with the tests shall be borne by the Contractor.
- ix) All aggregates shall be subject to the approval of the Engineer. Any

batch of aggregates not found to the required standard shall be rejected by the Engineer or his Representative and shall have to be removed from site without delay. Concrete structures executed with rejected aggregates shall be dismantled and rebuilt at the Contractor's expense.

- x) Special fine gravel of 9 mm (3/8") or 12 mm (1/2") maximum size shall be used if and where called for on the Drawings or as directed by the Engineer.
- xi) If suitable gravel meeting with the Specifications is not procured by the Contractor, he will have to arrange suitable crush stone if demanded by the Engineer. No extra payment shall be made to the Contractor to effect this change.

6.03.3 WATER shall be as specified under section on water.

6.04 CLASSIFICATION OF CONCRETE:

Classes of concrete to be used in various parts of the works shall be as indicated on the drawings and mentioned in Bill of Quantities. The concrete of various grades shall be proportioned as set out in Table-I appended hereto.

TABLE-I: Showing minimum required compressive strengths 150 x 150 x 150 mm (6"x6"x6") test cubes and minimum quantity of cement required per m³ or 100 cft. of finished concrete for various mixes and under various conditions.

Class of Concrete	Nominal Min. Ratio	Min. Qty. of Cement		Preliminary Cube strength				Work Cube	
		Lbs. per 100 cft.	Kg. / Cu. m.	at 7 days		at 28 days		at 7 days	
				Lbs./ Sq. in.	N/ Sq.mm	Lbs./ Sq. in.	N/ Sq.mm	Lbs./ Sq. in.	N/ Sq.mm
A.	1:1:2	3024	485	4000	28.0	4500	31.5	3000	21.0
B.	1:12:3	2520	404	3350	23.4	3750	26.3	2500	17.5
C.	1:2:4	2016	323	2700	18.9	3000	21.0	2000	14.0
D.	1:3:6	1344	216	1300	9.1	1500	10.5	1000	7.0
E.	1:4:8	1008	161	850	5.9	1000	7.0	650	4.5

6.05 PROPORTIONING OF CONCRETE MIXES:

6.05.1 All concrete shall be proportioned by volume for concrete mixes, unless specifically directed by Engineer to proportion them by weight, when the ratios will also differ. The proportions given above in Table-I are suitable only when the specific gravities of the aggregates are in the region of 2.5. The Contractor shall submit to the Engineer proposed mix designs for concrete to be used, based on preliminary laboratory tests to determine proportion of cement, aggregates and water in the concrete conforming to the quality and strength requirements specified herein. Preliminary test results of at least three different mixes of each class of concrete with varied water cement ratios shall be submitted. The results of 7 days and 28 days cube tests shall be used to establish the ratios between 7 days and 28 days strengths. The Engineer may make adjustments in the ratio of fine to coarse aggregate in the mix for a certain work. Preliminary design of mixes and testing shall be the responsibility of the Contractor. The proportion of voids in the coarse aggregate shall be controlled and if it exceeds 45% than sand and consequently the cement content shall be increased by the Contractor without any charge. If the proportion is less than 40%, sand shall be decreased but not the cement.

6.05.2 MAXIMUM ALLOWABLE WATER CONTENT:

All concrete specimens shall be made, cured and tested in accordance with British Standard or ASTM Standard. A curve representing the relation between the water content and the average 28 days Compressive Strength or earlier strength at which the concrete is to receive its full working load shall be established for a range of values, including all the compressive strengths shown on the plans, The curve shall be established by at least four points each point representing average values for atleast four specimens. The maximum allowable water content for the concrete shall be as determined from this curve and shall correspond to a strength 15% greater than indicated on the plans. No substitution shall be made in the materials used in the work without additional tests in accordance with this procedure to indicate that the quality of the concrete is satisfactory.

6.05.3 SLUMP TEST:

The Slump for concrete, determined in accordance with PS No.422:1964 "Slump Test for Concrete" shall be minimum of 25 mm (1") and a maximum of 75 mm (3") provided the requisite strength is obtained. Corrective additions to remedy deficiencies in aggregate gradations shall be used only with the written approval of the Engineer. When such additions are permitted the materials shall be measured separately for each batch of concrete.

6.06 BATCHING AND MIXING:

6.06.1 Concrete shall be mixed by a mechanical batch type mixing plant with adequate facilities for accurate measurements and control of each material entering the mixer and for changing the proportions to conform to varying conditions of the work. The mixing plant assembly shall permit ready inspection of operations at all times. The plant and its location shall be subject to approval of the Engineer. However, if approved by the Engineer, Volumetric batching can be adopted, using cement by weight, at 20°C or 70°F according to the following table:

Class Mix.	Nominal	Cement		Sand		Coarse Aggregate	
		Lbs.	Kg	Cft.	Litre	Cft.	Litre
A	1:1:2	110	50	1 3/4	35	2 2	70
B	1:1 1/2:3	110	50	1 3/4	50	3 2	106
C	1:2:4	110	50	2 2	70	5	140
D	1:3:6	110	50	3 2	106	7 2	212
E	1:4:8	110	50	5	140	10	280

Water shall be measured for every batch with due allowance made for water already present in aggregates.

6.06.2 **Batching** units where used shall be supplied with the following items:-

- i) Weighing unit shall be provided for each type of material to indicate the scale load at convenient stages of the weighing operations. Weighing units shall be checked at times directed by and in the presence of the Engineer or his Representative and required adjustments shall be made before further use.
- ii) Water mechanism shall be tight with the valve interlocked so that the discharge valve cannot be opened before the filling valve is fully closed and shall be fitted with graduated gauge.
- iii) Discharge gate shall control the mix to produce a rib boning and mixing of cement with aggregates. Delivery of materials from the batching equipment to the mixer shall be accurate within the following limits:-

<u>MATERIAL</u>	<u>PERCENTAGE BY WEIGHT</u>
Cement	1/2
Water	1/4
Fine Aggregate	1
Coarse Aggregate	2

6.06.3 **MIXING UNIT:**

- i) Operations:
Mixers shall not be charged in excess of noted capacity nor be operated in excess of noted speed. Excessive mixing requiring addition of water to preserve required consistency shall not be permitted. The entire batch shall be discharged before re-charging.
- ii) Mixing time shall be measured from the instant water is introduced into the mixer drum containing all solids. All mixing water shall be introduced before one-fourth of the mixing time has elapsed. Mixing time for mixers of one cubic meter or less shall be 2 minutes; for larger than one cubic meter capacity

mixers time shall be increased 15 seconds for each additional half cubic meter or fraction thereof. If an air-entraining agent is used, additional mixing time shall be allowed such as to provide the specified air-content.

- ii) Discharge Lock:
Unless waived by the Engineer device to lock the discharge mechanism, until the required mixing time has elapsed, shall be provided on each mixer.

- iv) No hand mixing under any circumstances even with extra cement shall be permitted. If during concreting, the mixing plant fails, the concrete already poured shall be removed, unless directed otherwise by the Engineer or his Representative.

6.07 SAMPLES AND TESTING:

6.07.1 GENERAL:

Test cubes of concrete shall be prepared and stored by the Contractor, in accordance with PS No.56O:1965, as and when directed by the Engineer or his Representative. Test cubes be tested in a laboratory and the Contractor shall bear the charges for the same. Aggregates shall be tested as prescribed.

6.07.2 CEMENT:

Cement shall be tested as prescribed in Pakistan Standard or British Standard or ASTM Standard.

6.07.3 AGGREGATES:

Aggregates shall be tested as prescribed in relevant Pakistan Standard or British Standard 812. In addition fine aggregates shall be tested for organic impurities in conformity with B.S. 812 or equal ASTM Standard or Pakistan Standard.

6.07.4 REINFORCEMENT:

Reinforcing bars shall be tested as prescribed in relevant Pakistan or British or ASTM Standards. Mesh Reinforcement shall be tested as prescribed in B.S.785 or ASTM A-185.

6.07.5 TESTING OF CONCRETE

- i) The Contractor shall provide for test purposes one set of six cubes taken for each class of concrete poured on each day. The Engineer or his Representative may, however, order for more cube tests if any irregularity is found in the concrete.

- ii) All test cubes shall be 150 x 150 x 150 mm (6"x6"x6") size.

- iii) All test cubes of the same set shall be made from the same batch of concrete.

- iv) Three cubes of the set shall be tested at 7-days and three shall be tested at

28 days or at such ages as directed by the Engineer or his Representative.

- v) All test specimens shall be made and cured in accordance with Pakistan Standard PS 56O:1965 or British Standard B.S. 1881 or ASTM C-31.
- vi) Specimens shall be cured under laboratory conditions except that the Engineer or his Representative may require curing under field conditions.
- vii) All cube moulds shall be steel moulds perfectly true having all internal and the meeting faces machined to a smooth surface.
- viii) If the strength tests of the laboratory controlled specimens for any portion of the work falls below the minimum allowable compressive strength at 28 days required for the class of concrete used in that portion, the Engineer or his Representative shall have the right to order replacement of the effected work.
- ix) All test cubes cast at site shall bear distinguishing mark showing serial number, date of casting, quality of concrete and place from where sample was taken and where that batch of concrete was placed in the structure. A proper daily record of test specimens made, test results obtained shall be maintained by the Contractor and weekly test results shall be submitted to the Engineer or his Representative.
- x) The Engineer or his Representative may require load tests for the part of the structure from where test specimens have shown unsatisfactory results at the cost of the Contractor. In the event that load tests indicate bad quality of concrete, measures as prescribed by the Engineer shall be taken to correct the deficiency at no additional cost to the Department. The nature, description and details of load test shall be determined by the Engineer and shall be binding on the Contractor.

6.08 TRANSPORTING AND PLACING CONCRETE:

- a. Concrete shall be conveyed and deposited as quickly as possible after mixing and shall proceed so that, as far as possible, a complete section of the work is done in one operation.
- b. Transport of concrete shall be in a manner approved by the Engineer's Representative and shall be so as to avoid segregation or loss of ingredients of concrete.
- c. All foundations and portions of work to be concreted shall be approved by the Engineer's Representative before concrete is poured.
- d. All forms and reinforcement shall be completed, cleared inspected and approved before pouring of concrete. No concrete is to be deposited till the Engineer's Representative has inspected and approved in writing all reinforcement, foundations, forms, details, positioning of all fixture and

materials to be embedded in concrete, control levels and screeds, etc. and is satisfied with the arrangements the Contractors has made to efficiently proceed with the work such as sufficient labour, materials, plants etc. Such an approval will not relieve the Contractor from any of his obligations under this Contract. Water shall be removed from excavations before concrete is deposited.

- e. Placing of concrete shall not be permitted when, in the opinion of the Engineer's Representative, the sun heat, wind, cold, snow or limitations or facilities furnished by the Contractor prevent proper placing, finishing and curing of concrete.
- f. All concrete shall be thoroughly compacted and consolidated by means of Pneumatic or mechanical vibrators or other approved compacting method. Care shall be taken to avoid segregation due o excessive vibration. The Contractor shall maintain on site at all times one or more stand-by vibrators. Tapping or other external vibration of forms shall not be allowed, unless so directed by the Engineer's Representative. Compaction shall be done until the whole mass assumes a jelly like appearance and consistency with the water just appearing on the surface. Concrete shall be sufficiently tamped and consolidated around the steel rods, care taken that the vibrator does not touch steel or formwork and into all parts of the moulds in order that no voids or cavities are left. Steel shall not be disturbed during operations of concreting. Concrete shall be brought up in even layers not more than 150 mm (6") thickness and worked against side of forms to give a smooth and uniform surface. No excessive water shall be allowed to come out and lie on the surface of concrete. The concrete must be of such a consistency that after ramming, consolidating and tamping is completed, a thin film of water is just appearing on the surface.
- g. Hardened concrete, debris and foreign material shall be removed from interior of forms and from inner surface of mixing and conveying equipments.
- h. Runways shall be provided for wheeled concrete handling equipment, and such equipment shall not be wheeled over reinforcement, nor shall runways be supported on reinforcement.
- i. Concrete shall not be dropped freely from a height of more than 3.5 m (12 ft) in columns and 1.5 m (5 ft) elsewhere. Incases where an excessive drop is inevitable the Contractor shall provide spouts, down pipes, chutes, or side parts to forms with pockets which will let concrete stop and flow easily into the form without any risk of segregation. The discharge of the spouts, down pipes or chutes shall be controlled so that the concrete may be effectively compacted into horizontal layers not more than 300 mm (12") thick.
- j. Concrete is to be deposited as quickly as possible after mixing and to proceed continuously. Concrete which has attained its initial set or has contained its mixing water for more than 30 minutes shall not be allowed to

be placed in the work.

- k. When concrete is laid on hard core, such as subgrade for floor slabs, or other absorbent material, the surface is to be watered, consolidated and, where specified, blinded before the concrete is deposited.
- l. Fresh concrete shall not be placed on previously laid concrete or on old concrete surfaces until the latter has been cleaned of dirt, scum and laitence by wire brushes. The clean surface shall then be thoroughly wetted and grouted with cement slurry as approved by the Engineer's Representative.
- m. Care shall be taken not to disturb newly placed concrete by vibrator, indirect loading or otherwise. No traffic or loading shall be allowed on the concrete until it has thoroughly set and hardened.
- n. Construction joints in concrete shall only be given at locations indicated on the drawings or as approved by the Engineer or his Representative. At the end of the day's work the concrete shall be finished off against a temporary shutter stop, which shall be vertical and securely fixed. Such stops shall be removed within 24 hours of placing of concrete. Construction joints not shown on the drawings shall be reinforced with steel bars or dowels, if deemed necessary by the Engineer or his Representative shall be furnished by the Contractor without any additional payment.
- o. No concrete shall be placed during rains or in inclement weather and all fresh concrete shall be suitably protected from rain-fall and excessive heat or cold.
- p. Should any part of the exposed surface present a rough uneven or imperfect appearance when the shuttering is removed. It shall be picked out to honeycomb depth and refilled and properly re-surfaced or entirely redone as per directions of Engineer or his Representative at the cost of the Contractor.
- q. On removal of the forms and before the skin has had time to harden, all faces of the concrete inside or outside, to be kept exposed shall be rubbed over with carborandum stone, and washed with cement to remove all marks, projections, hollows or any other defect. No extra payment shall be made for this work.

All exposed surfaces and lines of the concrete work are to be true and fair without cracks, bends, windings and distortions of all kinds, and if occurring, shall be removed without any extra charges by the Contractor. All un-plastered concrete works is to be fair face, smooth, pleasing and to the entire satisfaction of the Engineer or his Representative.

- r. A float or screed is to be worked over the exposed surfaces of all concrete work on the flat or curve, so as to render the surfaces perfectly smooth, clear, and to the necessary slopes or falls or as required to receive the floor or roof finishes, according to the drawings, and as directed by the Engineer or his Representative without any extra charges by the Contractor.

6.09 PROTECTION AND CURING:

All exposed concrete shall be cured. Curing shall be accomplished by preventing

loss of moisture, rapid temperature change and mechanical injury or injury from rain or flowing water for a period of at least ten (10) days. Curing shall be started as soon as the concrete has hardened sufficiently for the surface not to be marked. Curing shall be done either by continuous sprinkling of water on the surface or by covering with sand, hessian, canvas or other approved fabric mats, which shall be kept continually wet. If required and so directed by the Engineer or his Representative, formed surfaces with forms in position shall also be cured by keeping all forms continually wet. As an alternative, curing of concrete, on all exposed surfaces which could not be kept covered, such as sides of the beams, under side of the slabs, may also be done by sealing concrete surfaces with curing compounds like "Paccacure" or equal so as to arrest loss of moisture from concrete, with approval of Engineer or his Representative. The Contractor shall take special care that curing of concrete is satisfactorily carried out and in accordance with methods specified herein and / or as instructed by the Engineer or his Representative. Any negligence in this regard may result in total rejection of such concrete works, which in the opinion of the Engineer or his Representative have not been adequately cured.

Minimum period of curing for any concrete shall be 10 days or more as directed by the Engineer. All concrete components of concreted structures shall be clearly marked with non-washable paints to indicate the date of placing concrete. During hot weather, curing shall be done even at night.

6.10 FORMWORK:

6.10.1 General

The formwork shall be inclusive of all labour, material, workmanship and alike. All form work and supports thereto shall be designed by the Contractor and relevant drawings shall be submitted to the Engineer and his Representative for approval before the work is put in hand. Such an approval shall not relieve the contractor from all the obligations of the contract or give rise to any claims.

6.10.2 Making Forms

The form-work for columns, beams, slabs lintels fins, shells, blocks, panels, purdees, surrounds for windows, and all other works whether to be precast or cast in situ shall be made of sound and properly seasoned timber or other approved material and shall be rigidly formed and designed by the Contractor to the shapes and forms as per drawings in accordance with the best of the existing practices so as to be able to withstand, without displacement, deflection or deformation movements of any kind, the pressure of the moist concrete and all other loads. For concrete work to show an even finish the timber forms be properly lined with plywood or steel sheets to give a fair face concrete of a homogenous, perfectly even and smooth appearance in exposed surfaces of all beams, columns, walls, slabs, etc.

6.10.3 Rigid with Allowance for Camber and Bulges

It shall be fabricated and erected in position, perfect in alignment, levels and true to plumb and shape and securely braced so as to enable it to stand all weights, live and vibrating to be endured during placing of concrete and its subsequent

hardening till the form work is struck. It shall be so sufficiently rigid as not to loose its form and shall be so made for bulging, and deflection as to give the finished concrete to the required lines, plumb, size and shape.

6.10.4 Exposed Surfaces Left Unplastered

For concrete work covered in this contract where concrete Surface is to be exposed in the finished work and left unplastered, the form-work shall be smoothly faced by using plywood sheets or lining the shuttering with smooth steel sheet or non-absorbent material like formica sheets or in any manner as approved by the Engineer or his Representative, so as to make a perfectly smooth surface of the finished concrete. Where any surface defects on the exposed concrete surfaces occur and which do not impair the structural performance, being in excess of the designed surfaces, and the architectural appearance of the work in the opinion of Engineer or his Representative, such defects may be removed by guniting and grinding with corborandum stone or in any other approved manner, at the cost of the Contractor, otherwise the whole or part of the work may have to be removed and remade good by the Contractor at his own cost. For precast concrete members the forms shall be rigid, exact, smooth and made of steel.

6.10.5 Materials and Labour

The Contractor shall supply all materials and labour, necessary for a good and speedily erection of form-work such as shuttering, planks, struts, bolts, stays, gangways, boards, fillets etc. and shall do all that is essential in executing the job in a workman like manner to the satisfaction of the Engineer.

6.10.6 Form Work not to Interfere or Injure Work

The form-work shall be so designed and arranged as not be unduly interfere with concrete, during its placing, and easy to be removed without injuring the finished concrete, wedges, clamps, bolts and the rods shall be used, when permitted and where practicable, in making the form work rigid and in holding it to true position.

6.10.7 Opening in Form-work

Wherever the Concreting is required to be carried out within forms of considerable depths, temporary openings in the side of the form shall be provided to facilitate the pouring and consolidation of the concrete. Small temporary openings shall be provided at the bottom of all forms to permit the removal of rubbish etc.

6.10.8 Openings and other details

Provision shall be kept in the form-work such as openings, recesses holes, pockets, fillets, etc for housing services and other architectural details in the finished concrete or on its surface and edges as shown on drawings or as directed by the Engineer or his Representative to fix all necessary inserts, dowels pipes, holdfasts etc. as shown on drawings or as directed.

6.10.9 Joints in Form-work

All joints in the formwork shall be sufficiently closed to prevent undue leakage of mortar for concrete surface not to be exposed in the finished work. The joints in the form-work for all concrete surfaces to be exposed in the finished work shall be close

jointed and perfectly smooth so as not to allow any leakage of the mortar from the concrete; and show any appearance of leaking mortar on concrete surface.

6.10.10 Treatment and Inspection of Forms

All rubbish, particularly chipping, shavings, and sawdust etc. shall be removed from the interior of the forms, immediately before fixing of bars. Forms shall be coated with approved mould oil before reinforcement is placed. Surplus oil on forms and any oil on reinforcing steel shall be removed. Forms surface not exposed to view or normal watering may thoroughly be wetted with soap and water in place of oiling before placing concrete. If the forms are not used within 24 hours, a fresh coat of oil shall be given before placing of concrete.

6.10.11 Striking Shuttering

No struts or timbering which serve the purpose of supporting the shuttering or centering shall be struck and removed without direct permission from the Engineer or his Authorized Representative in writing and the work of striking and removal after the receipt of such permission shall be conducted under the personal supervision of the competent foreman in the employment of the Contractor and the Contractor shall hold himself fully responsible for any consequences whatsoever. In all cases the Engineer or his Authorized Representative will direct and control the minimum period of time for which the forms, shuttering or centering shall remain in place before being struck; but, for the general guidance of the contractor, when normal Portland Cement has been used in the work, the following are to be considered as the minimum periods in days for the main classes of work:

Removal of Shuttering	10 °C (50°F)	20 °C (70°F)
Beams sides, walls & Columns (unloaded)	03	02
Slabs soffits (props left under)	09	06
Removal of props to slabs	18	14
Beams soffits (props left under)	18	12
Removal of props to beams, and shuttering under shells.	24	18

The Engineer or his Representative may require, however, that any walings, soldiers, struts or other timbers or supports, the removal of which may cause the transference of load to the finished work, to be kept in place for three weeks after the placing of the concrete.

6.10.12 Injury or Damage.

The Contractor shall be responsible for any injury to the work and any consequential damages caused by or arising from the removal and striking of forms, centering and supports, due to striking too soon, and any advice, permission or approval given by the Engineer or his Authorized Representative, relative to the removal and striking of forms, centering and supports shall not relieve the Contractor from the

responsibilities herein defined.

6.10.13 Treatment after Removal of Forms.

Any minor surface honey-combing or other irregularities are to be properly made good immediately upon the removal of the form-work and the surface made good to the satisfaction of the Engineer and his Representative. Any small voids shall be neatly stopped with cement mortar consisting of one part of cement to two parts of sand and the whole surface rubbed over with corborandum stone and cement wash and bring the whole to a smooth and pleasing finish and uniform colour.

No form-work shall be measured and paid for separately and shall be deemed to be included in the unit price of concrete whether cast-in-situ or precast and subsequently fixed in position.

6.11 FINISHING OF FORMED SURFACES

6.11.1 SPECIAL ARCHITECTURAL FINISHES

- i) Textured finishes - Textured form liners may be of form plastic sheet, wood sheet, metal, or other material. 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 be imparted to the surface of the concrete. Edges of textured panels shall be sealed to each other or to divider strips (if specified or shown) to prevent bleeding of grout. The sealant used shall be non-staining to the surface.
- ii) Aggregate transfer finishes - Aggregate transfer and other special finishes shall be produced using methods and materials in such a way as to duplicate sample panels prepared in advance.
- iii) Applied finishes - When special finishes 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 about 24 hours old, it can be roughened with a heavy wire brush or scoring 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 applied.

6.11.2 RUBBED FINISHES

The following finishes shall be produced to 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 placement as possible without jeopardizing the structures.

- i) Smooth rubbed finish - Smooth rubbed finish shall be produced on newly hardened concrete not later than the day following from removal. Surfaces shall be wetted and rubbed with car texture are produced. No cement grout shall be used other than the cement paste drawn from the concrete itself by rubbing process.
- ii) Grout cleaned finish - No cleaning operation shall be permitted until all

continuous surfaces to be cleaned are completed. Mix 1 part Portland cement and 1 1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paste. White Portland cement shall be substituted for a part of the grey Portland cement in order to produce 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 brushes or a spray gun. Immediately after applying the grout, scrub the surface vigorously with a cork float or stone to the surface and fill all air bubbles and holes. While the grout is still plastic, remove all excess grout by working the surface with rubber float, sack, or other means. After the surface whitens from drying (about thirty minutes at normal temperatures), rub vigorously with clean burlap. The finish shall be kept damp for at least 36 hours after final rubbing.

- iii) Cork floated finish - Remove from at an early stage, within 2 to 3 days of placement where possible. Remove ties. Remove all burrs and fins. Mix one part Portland cement and one part fine sand with sufficient water to produce a stiff mortar. Dampen wall surface. Apply mortar with firm rubber float or with trowel filling all surface voids. Compress mortar into voids using a slow - speed grinder or stone. If the mortar surface dries too rapidly to permit proper compaction and finishing, apply a small texture with a cork float using a swirling motion.

6.11.3 UNSPECIFIED FINISH

If the finish is not designated and applied finishes are also not indicated the following finishes shall be used as applicable:

- i) Rough form finish - For all concrete surface not exposed to public view.
- ii) Smooth form finish - For all concrete surfaces exposed to public view.

6.11.4 RELATED UNFORMED SURFACE

Tops of walls or buttresses, horizontal off-sets, and similar unformed surfaces occurring adjacent to formed surfaces shall be floated to a texture reasonably consistent with that of the formed surfaces. Final treatment on formed surfaces shall continue uniformly across the unformed surfaces.

6.12 CONSTRUCTION JOINTS:

Construction joints shall be located as indicated on the drawings and/or as approved or directed by the Engineer or his Representative. For slabs and beams construction joints shall be located at mid point of the span unless a secondary beam intersects a main beam at the centre in which case the joints in the main beam shall be off set a distance equal to twice the width of the beam and provision for shear shall be made by the use of inclined reinforcement at the cost of the Contractor. Joint in columns shall be made at the under side of the deepest beam framing thereto. Beam stems shall be poured monolithically unless directed otherwise by the Engineer. Joints not specified or shown on the drawings shall be so located as to least impair the strength and appearance of the work. Except where

indicated on the drawings no jointing shall be made in footings or foundations without written approval of the Engineer or his Representative. Construction jointing shall be at right angles to the member and shall be formed against firm stop boards. The stop boards shall be removed as soon as possible after placing the concrete but without the risk of movement of the concrete and the concrete surface shall be well brushed with a hard brush and washed off with a spray of water, two to four hours after casting, to expose the aggregates and provide a key for the next pour. In all liquid retaining structures and other sub-structures pits and trenches etc. PVC or any other approved water stops shall be provided at the construction joint in the manner shown on the drawings and/or approved by the Engineer or his Representative.

Whenever a section of concrete is left unfinished, for any reasons with the approval of Engineer's Representative, leaving a surface which will be hard set before additional concrete can be joined to it, dovetails, grooves or other bonds with the new work shall be provided at cost of the Contractor. Before depositing fresh concrete upon or against any concrete which has already set, the surface of the set concrete shall be roughened with a cutting tool, any laitance removed, thoroughly cleansed of all foreign matter, well watered and covered with cement grout, and special care shall be taken to ram the fresh concrete thoroughly up and against the set concrete; and, if deemed necessary by the Engineer or his Representative the joints shall be reinforced with steel bars or dowels to be all furnished and done by the Contractor without any additional payment.

6.13 CONCRETE FLOOR SLAB FINISHING:

6.13.1 GENERAL

Concrete slabs shall be finished as described herein. In preparation for finishing, floor slabs shall be struck off to the required level at or below the elevation or grade of the finished floors as shown on the drawings. Floors shall be leveled with a tolerance of 1 mm in 1 m (1/8" in 10 feet) except where drains occur in which case the floors shall be pitched to the drains as indicated on the drawings or as directed by the Engineer.

6.13.2 MONOLITHIC FINISH

All concrete surfaces in floors except where other finish is specified shall be finished by steel floats or straight edges to bring the surface to the required finish level shown on the drawings. While the concrete is still green but sufficiently hardened to bear a man's weight without deep imprint it shall be wood floated to a true even plane with no coarse aggregate visible. Sufficient pressure shall be used on the wood floats to bring moisture to the surface. The concrete shall then be hand troweled to produce a smooth impervious surface free from trowel marks. If necessary, the process shall be repeated so that the final finish shall produce a ringing sound from the trowel. No separate payment shall be made for finishing floor slabs in the fore mentioned manner.

6.13.3 CONCRETE TOPPING

Where indicated on the drawings base slab under concrete topping shall receive a screeded finish. After the base slab is thoroughly cured and when directed concrete

topping shall be laid to the thickness as indicated on the drawings in alternate panels of suitable sizes as directed by the Engineer or his Representative.

6.14 ANCHOR BOLTS, INSERTS, SLEEVES, CHASES, RECESSES STEEL FRAMES ETC:

The Contractor shall furnish and place in position accurately shown on drawings, all inserts, sleeves, chases, recesses, etc., supplied by himself or other Contractors, as directed, by the Engineer and full cooperation and co-ordination shall be maintained with other Contractors, sub-contractors in this regard.

6.15 WATERPROOF CONCRETE:

Wherever specified on the drawings all liquid or water retaining structures and those subject to water pressure shall be executed with approved waterproof concrete. The water proofing compound shall be of the approved type and shall be mixed with the concrete in strict accordance with the manufacturer's directions and/or as directed by the Engineer or his Representative.

6.16 CLEANING AND REMOVAL OF RUBBISH:

On completion of works herein the Contractor shall remove all concrete debris, rubbish, shuttering materials, scrapes etc., from the vicinity of the structures completed. All areas shall be cleaned to the satisfaction and approval of the Engineer or his Representative.

6.17 COORDINATION:

The Contractor shall provide chases and openings required for other sections of the work and will co-operate and coordinate with other trades in placing their pipes, ducts, reglets and other built-in-items as the work proceeds.

6.18 EXTERNAL EXPOSED CONCRETE SURFACE:

All external exposed un-plastered concrete surfaces of cast in situ or precast units shall be given smooth or pattern finish as shown in the finishing schedule or as directed by the Engineer or his Representative. No separate payment shall be made to the Contractor for this work and it shall be included in the item rates of the respective concrete items in the bill of quantities.

6.19 PARTICULAR SPECIFICATIONS FOR CONCRETE

- a) Allowable bearing pressure of soil for foundation is marked on the drawing of the foundation. It is to be checked that no foundation is placed on the soil with a lower bearing capacity. In cases any weaker strata is encountered at any level the matter is to be reported to the Engineer for necessary changes in footings.
- b) Level of foundations as indicated on the drawings may be varied at site to reach the suitable strata. This matter is to be decided by the Engineer at site.
- c) Before concreting, the excavated surface to receive the concrete should be cut to proper levels. All loose soil is to be removed.
- d) Minimum strength requirements of various concrete mixes at 28 days actually being used for work using ordinary Portland cement shall be as follows:-

Concrete Mix:	1:1:2	-	4500 p.s.i. (Class 'A')
	1:1 1/2:3	-	3750 p.s.i. (Class 'B')
	1:2:4	-	3000 p.s.i. (Class 'C')
	1:3:6	-	1500 p.s.i. (Class 'D')
	1:4:8	-	1000 p.s.i. (Class 'E')

- e) All R.C.C. work shall be in 1:2:4 concrete mix unless otherwise indicated for a richer mix on the drawing or specified.
- f) All concrete is to be thoroughly vibrated mechanically:
- i. Any concrete failing to meet the specified strength or not formed as shown on drawings, concrete out of alignment, concrete with surfaces beyond require tolerances or with defective surfaces which cannot be properly repaired or patched in the opinion of Engineer=s Representative shall be removed and replaced at Contractor=s expense. The Engineer=s Representative may reject any defective concrete and order it to be cut out in part or in whole and replaced at the Contractors expense. Only in case of minor surface defects the Engineer=s Representative may approve a surface treatment immediately after from removal.
 - ii. All ties and bolt holes and all repairable defective area shall be patched immediately after removal.
 - iii. All honeycombed and other defective concrete shall be remove down to sound concrete. The area to be patched and area at least 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 passing a No. 25 B.S. Sieve, shall be mixed to the consistency of thick cream and shall then be well brushed into the surface.
 - iv. 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 mortar shall consist of not more than 1 part cement to 22 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.
 - v. The quantity of mixing water shall be not 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 has reached the stiffest consistency that will permit placing.
 - vi. 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 lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to permit initial shrinkage, it shall be left undisturbed for at least 1 hour before being finally finished. The patched area shall be kept damp for 7 days. Metal tools shall not be used in finishing a patch in a formed wall, which will be exposed.

- g) For heavy concrete members the form work is to be properly designed and approved by the Engineer.
- h) Shuttering should not be struck earlier than the time specified unless otherwise approved by the Engineer.
- i) 18 gauge G.I. binding wire to be used for securely binding the reinforcing bars to avoid dislocation or displacement during concreting.
- j) Clear cover to main reinforcement in concrete members be as follows:-
- | | | |
|------|---|----------|
| i) | For slabs, projections chajjas, fins, walls, staircases precast slabs | .. 3/4" |
| ii) | For beams, Columns, all members of water tank on the side in contact with water | . 1 1/2" |
| iii) | For foundations, retaining walls and foundation beams | . 2" |
- k) All the reinforcing bars are to be properly placed as shown on the working drawings. Steel chairs and concrete spacer blocks are to be used without any extra cost. Concrete spacer blocks are to be properly cured to avoid their damage during concreting, thereby causing displacement of bars. Holes made by bolts etc. introduced for keeping the shuttering in tact should be properly treated after striking the shuttering. No such holes shall be allowed in walls of water retaining structures and earth retaining walls.
- l) All bent up bars in slabs are to be properly secured in position. Workers or trollies shall not be allowed in any case over the reinforcement mesh.
- m) Special care is to be taken to see that all expansion joints shown on the drawings are made in perfect straight line and treated as specified.
- n) Construction joints in beams and slabs shall be located at the centre of the span (such that a proper seat is formed for the next part to be cast); unless otherwise indicated on drawings or approved by the Engineer.
- o) DPC
The Concrete mix of DPC will be CC 1:2:4 as specified in this chapter. To protect the dampness water proofing agent APudlo@ or any other water proofing agent as approved by the Engineer will be mixed in CC 1:2:4 @ the ratio of 5 lbs per bg of cement. The DPC will be cured for at least 10 days.

6.20 MEASUREMENT AND PAYMENT

All the concrete work shall be measured net as per execution at site in square or cubic feet for the related items and shall be paid at the rate entered in the BOQ appended to the contract in accordance with the conditions of contract. The rates are inclusive of all type of form-work, its erection and removal, all scaffolding, cost of mixing and batching plants, all T&P required for executing and placing the concrete work in position and Water Stopper, Bitumen Coating etc. Defective and honey-combed work will not be measured & paid and will be liable to be rejected and redone at contracts' cost.

SECTION - 7

7.0 STEEL REINFORCEMENT

7.01 SCOPE OF WORK:

The work covered by the section of the specification consists of furnishing all materials, tools, labour and in performing all operations in connection with the providing, straightening cutting, bending, binding, fixing, including binding wire, chairs, pins, spacer block complete in strict accordance with this section of the Specifications, the applicable drawings, approved bar bending schedule, and the terms and conditions of the Contract.

7.02 MATERIALS:

- A. Reinforcing steel to be new billet stock of mild steel (plain bar), hard grade (deformed bar) and Ribbed Tor steel as specified on the drawings and shall conform to British Standard Specifications or equivalent ASTM or Pakistan Standard.
- B. The Contractor shall furnish to the Engineer's Representative Manufacturers' mills certificate to guarantee that steel meets the standard, specifications requirements and minimum certified yield stresses as follows:-
- i) Mild Steel plain bars conforming to B.S.S. 15 or B.S.S. 4449 or PS-231-1962
 - a) Tensile Strength - 438 to 517 N/Sq.mm (28 to 33 tons/Sq.in).
 - b) Yield Strength - 250 N/Sq.mm (16 Tons/Sq.in)
 - c) Elongation - 16% to 24% (av. 20%).
 - ii) Hard grade deformed bars conforming to ASTM, A-15-85 T. or PS-605-1962
 - a) Tensile Strength - 560N/Sq.mm (35.7 Tons/Sq.in).
 - b) Yield Strength - 350 N/Sq.mm(22.3 Tons/Sq.in).
 - c) Elongation - 1100 000 x %

Tensile Strength
 - iii) Ribbed Tor steel conforming to B.S. 4461
 - a) Tensile Strength - 490 N/Sq.mm(70,000 lbs/Sq.in).
 - b) Yield Strength - 420 N/Sq.mm(60,000 lbs/Sq.in).
 - c) Elongation - 14.5%
- C. All steel to be true to the Standard Specifications with regard to bend ability specially the hard grade deformed bars under 19 mm (3/4") dia. shall be capable of being bent cold through 90 degree round a bar of four times its own diameter without fractures or injury of any kind. In case of deformed bars

over 19 mm (3/4") dia. and under 28 mm (1-1/8") dia. round a bar of 6 times its own diameter.

D. 18 gauge galvanized wire shall be used for binding the steel reinforcement.

7.03 TESTING:

Reinforcement shall be obtained only from manufacturers approved by the Engineer=s Representative.

If and when required samples shall be tested for above specification in an approved laboratory when required by the Engineer or his Representative and all costs of such tests shall be borne by the Contractor.

7.04 STORAGE

Reinforcing bars shall be stored on platforms above surface of ground and be free from scales, oil, structural defects prior to placement in works. Rusted or dirty steel bars shall not be used in the works unless brushed and cleaned by proper steel wire brushes and after being approved for use by the Engineer or his Representative.

7.05 REINFORCEMENT CUTTING AND PLACING

A. All reinforcement steel shall be cut and bent cold in strict accordance with bar bending schedules approved and drawings supplied by Engineer. The Contractor shall prepare bar bending schedule from approved structural working drawings and instructions to be provided to him by the Engineer. The bending schedules shall be drawn on approved forms and submitted to the Engineer or his Representative for checking and approval. The steel reinforcement shall be cut and bent to sizes as per drawings and approved bending schedules. In case any bars, cut, bent or even fixed in position are found incorrect in dimensions size or shape according to the requirements of the drawings and instructions of Engineer, the Contractor shall replace such steel bars cut bent or fixed in position by correct sized bars at his own cost and no extra payment shall be made to the Contractor on such account. The system of holding bars in place shall ensure that all steel in top section will support weight of workmen without displacement or distortion. Suitable spacers and chairs as approved by the Engineer or his Representative shall be used for supporting and spacing purposes of bars. In case any bars are bent or displaced they shall be straightened or replaced prior to pouring. All reinforcement bars within the limit of a days pour shall be in place and firmly tied with 18 gauge G.I. wires. Bars with kinks or bends not shown on drawings shall not be used.

B. Where indicated in the drawings, mesh shall be of the sizes as shown on drawings and conform to British Standard B.S.785. Mesh reinforcement when used in slabs shall be supported at proper elevations by standard accessories. In slabs on ground, pre cast concrete blocks may be substituted for chairs.

7.06 LAPS AND SPLICES

- A. No splicing of bars shall be allowed at position other than shown on the drawings. All lap lengths shall be of the minimum sizes as indicated on the drawings and in no case shall lap length be less than 40 times the diameter of the bigger lapping bars for nominal M.S. bars. Hard grade bars and tor steel shall have laps of 50 time the bigger diameter of lapping bars. Splices of adjacent bars shall be staggered unless approved otherwise by the Engineer or his Representative.
- B. All reinforcing steel fixed in position shall be inspected by the Engineers Representative and no concrete shall be poured until steel placement has been approved by the Engineers Representative. For inspection purposes the Contractor shall give to the Engineers Representative reasonable notice before the scheduled pouring time. Clear concrete cover to reinforcement steel shall be as indicated on the drawings/specified.

7.07 MEASUREMENT AND PAYMENT

- A. The quantity to be paid for shall be the calculated in theoretical number of metric ton of reinforcement steel bars or mesh as determined from the approved bar bending diagrams and incorporated in the concrete and accepted, except when reinforcement is paid for under other items.
- B. The weight of plain or deformed bars will be computed from the theoretical weight of plain round bars of the same nominal size as shown in the following tabulation:

Size in.	Weight in lbs per ft.	Size in.	Weight in lbs per ft.
1/4	0.167	3/4	1.502
3/8	0.376	7/8	2.045
1/2	0.668	1	2.670
5/8	1.043	1 1/8	3.380

- C. Clips, ties, separators, and other material used for positioning and fastening the reinforcement in place, and structural steel, shall not be included in the weight calculated for payment under this item. If bars are substituted upon the Contractor's request and as a result more steel is used than specified only the amount specified shall be included.
- D. When laps are made for splices, other than those shown on the drawings or required by the Engineer and for the convenience of the Contractor, the extra steel shall not be measured nor paid for.
- E. When continuous bars are shown on the drawings, without the splices being shown, the necessary steel in the splices will be paid for on the basis of the individual bars not being shorter than 40 ft.

- F. The accepted quantity measured as provided above shall be paid for at the contract unit price for the items listed in the Bill of Quantities which price and payment shall be full compensation for furnishing materials, labour, equipment and incidentals necessary to complete the item.

SECTION – 8

8.0 BRICK MASONRY

8.1 GENERAL

- a) Scope
This section of the Specification covers solid brickwork.
- b) Related sections of the specification
Section 6.1 for Cement Plaster
- c) Exclusions
The scope of work does not include supply of embedded items, other than those specified herein.
- d) Classification of bricks and brickworks
 - i) "Fair face bricks" --- bricks selected from first class bricks, having better surface and more uniform size and colour.
 - ii) "Fair face brickwork" --- using fair face bricks in brickwork required to be pointed and exposed to view.
 - iii) "First class bricks" m conforming to the requirements of Clause 3.1.2(b) specified hereinafter.
 - iv) "First class brickwork" --- using first class bricks, in brickwork required to be plastered.
- e) Submittals
 - i) Specimen samples of all materials and bricks intended to be used in the Works. Specimens of bricks shall be representative of a complete range of colors, textures and sizes.
 - ii) Results of all the tests performed on the materials and bricks as may be considered necessary by the Engineer to establish compliance to specification.
 - iii) Reference panel and sample panel of brickwork as per BS 3921: 1985, if required by the Engineer.
- f) Quality control and testing
 - i) General
Carryout regular quality control of the works and ensure that materials, construction and workmanship are in compliance with the plans and specification. Maintain quality control and test records and make available to the Engineer as a routine, as may be required by him.

ii) Quality control

Quality control shall include, but is not limited to, the following:

- that all materials meet the requirements of specification,
- that they are properly stored and prepared for use,
- that mortar and grout are properly mixed using specified proportions of ingredients, and
- that the method of measuring materials for mortar and grout are such that the proportions of the constituents are entirely controlled .

Brick shall pass a visual inspection for soundness, compact structure, reasonably uniform texture and shape; freedom from cracks, warpage, large pebbles, balls of clay or particles of lime that would affect the serviceability or strength of the brick.

- iii) All brickwork shall be erected plumb and true to line and level with maximum variation in any storey height or any length of wall being one mm in one metre.

8.2 MATERIALS

a) Mortar

i) Cement

Comply with requirements of BS 12: 1989. Use ordinary Portland cement (grey) unless specified otherwise.

ii) Sand

Comply with requirements of BS 1200: 1976 with Amendments 1, 2 & 3, for "Building sands from natural sources". Grading S of table below is preferred.

BS Sieve	Percentage by mass passing BS sieves	
	Type S	Type G
mm		
6.30	100	100
5.00	98 – 100	98 – 100
2.36	90 – 100	90 – 100
1.18	70 – 100	70 – 100
microns		
600	40 – 100	40 – 100
300	5 – 70	20 – 90
150	0 – 15	
75	0 -5*	0 – 8**

* 0-10% for crushed stone sands

** 0-1 2 % for crushed stone sands

Store sand at the Site in such a manner that it is not mixed with foreign matter. Methods employed by the Contractor for unloading, loading, handling and storage shall be subject to the approval of the Engineer. Maintain sufficient quantity at the Site at all times to ensure continuous work.

iii) Water

Do not use seawater or brackish water containing more than 100 ppm chloride ion or 2000 ppm sulphate ion for mixing or curing concrete. Water shall be clean and free from harmful matter and shall comply with the requirements of appendix A of BS 3148: 1980. Avoid contamination during storage.

iv) Mortar composition

Cement to dry sand ratio by volume as specified.

v) Mortar batching and mixing

Employ methods and equipment for mixing mortar so as to accurately determine and control the amount of each separate ingredient entering into the mortar, subject to the approval of the Engineer. Unless mixing by hand is allowed by the Engineer, mix mortar in a mixer which shall be of approved design and the mixing time after all the ingredients are in the mixer, except for the full amount of water, shall not be less than two minutes. Mix mortar only in quantities just sufficient for immediate use and waste all mortar not used within 30 minutes after addition of water to the mix. Do not retamper mortar. Thoroughly clean and wash mixing troughs and pans at the end of each day's work.

b) Bricks

Bricks shall be made from carefully selected earth which shall be good loam or clay. The earth shall be free from objectionable quantities of lime, gravel, coarse sand and roots and other organic matter. Brick shall be manufactured from clay which has been carefully weathered, worked, pugged and tampered, hand molded.

The bricks shall be thoroughly burnt but without being vitrified, uniform in shape, size, homogeneous texture, colour and shall produce a ringing sound when struck. The bricks shall be free from flaws, cracks, chips, stone, nodules of lime or kankar or other blemishes. Bricks shall have sharp edges, square corners and parallel faces.

Brick shall usually measure **9" x 4-3/8" x 2-11/16"** (nominal size) so that every four courses laid shall measure one foot in height.

Tolerance in dimensions shall be as under:

- Over 2" and upto 3" + 1/16"
- Over 3" and up to 4" + 1/8"
- Over 4" and up to 6" + 3/16"
- Over 6" and up to 10" ± 1/4"

Although bricks may have been approved at site of kiln or at Site of Work they shall be liable to rejection thereafter at any stage even after they have

been built into the Work, if they are found not to comply in all respects with the specification.

c) Metal ties

Unless approved otherwise by the Engineer or shown on drawings:

- (i) Cavity wall ties - comply with the requirements of BS 1243: 1978 as approved by the Engineer.
- (ii) Ties for jointing concrete and brickwork - 6mm dia x 300mm long, MS galvanized.

8.3 DELIVERY AND STORAGE

The methods and equipment used for transporting the bricks and mortar shall be such as will not damage the bricks nor delay the use of mixed mortar.

Masonry materials shall be so stored that at the time of use the materials are clean and structurally suitable for use.

STACKING, SAMPLING AND TESTING

Sort out and arrange the bricks in stacks of one or two thousands or as directed by the Engineer. Each stack shall be 10 courses high and two bricks thick so that at least 0.6 metre space between the stacks shall be left for the purpose of inspection. Stack each size or class of brick separately. For purposes of inspection and tests, the sample bricks shall be selected by the Engineer.

Bricks shall be sampled and tested for compressive strength and water absorption as per BS 392: 1985. Average compressive strength shall not be less than 2000 psi and that of individual brick not less than 1600 psi. Water absorption shall not be more than one - sixth of the dry mass of brick.

8.4 SCAFFOLDING

Provide and erect safe scaffolding of adequate strength for use of workmen at all levels and heights. Do not use scaffolding which in the opinion of the Engineer is unsafe, until it has been strengthened and made safe for use of workmen.

8.5 EXECUTION OF WORK OF FIRST CLASS BRICKWORK

- a) Compliance with Standard
Comply with the relevant applicable requirements of section - 4 of BS 5628 : Part 3 1985 with amendment No.1.
- b) Soaking and washing bricks
Before use, soak bricks in clean water for at least 4 hours. If bricks contain soluble salts liable to cause efflorescence, wash bricks thoroughly to satisfaction of the Engineer.
- c) Laying
Do not lay brickwork during rain sufficiently heavy or prolonged to wash the mortar from the bricks. Remove and replace already laid mortar which

becomes diluted by rain.

Lay bricks in English bond with frogs (manufacturer's marks) upwards. Set each brick with both bed and vertical joints filled with mortar and bed-in bricks by tamping with the handle of the trowel. Do not simply cover brickwork with mortar at edges. Lay bricks with all horizontal joints parallel and truly level, and vertical joints in alternate courses directly over one another. Thickness of horizontal joints unless approved otherwise shall not be less than 6mm and not more than 10mm such that the height of 4 courses and 3 joints as laid shall not exceed by more than 25mm the height of 4 bricks piled dry one upon the other. Thickness of vertical joints shall be approximately 10mm. Lay all brickwork truly plumb and check each set of four brick courses with plumb bob and straight edge. Do not use bats except where absolutely necessary for obtaining the specified bond. At all corners lay alternate course~ of bricks as headers and stretchers so as to bond the two walls together. Where fresh brickwork is to join brickwork that has partially or fully set, clean roughen and wet the exposed jointing surface of the set brickwork so as to effect the best possible bond with the new work. At intersections, interlock brickwork so as not to leave a straight vertical joint.

Where neither plastering nor pointing is to be provided, as in foundations and plinth, fill the joints flush with the same mortar as used for laying brickwork as the work progresses and strike the joints. Where plastering or pointing is to be applied, rake out joints with a hook to a depth of 12mm before the mortar sets, each day.

Cut, dress or groove bricks as required for shaping jambs, fitting frames and for architectural features of the building. Make corners with cut-bricks. Build in brickwork all frames and inserts required to be installed as the work progresses, maintain them in their proper position and do not remove until they are firmly held in brick work. Fill the spaces around all built-in work with concrete of approved mix. Leave openings for ducts and other uses where required. Make and install formwork for arches to conform to the required shape.

Carry up brickwork regularly and leave no portion of work more than one metre lower than another. Rake back temporary stops left during construction. Mark course marks with saw cuts on straight edges supplied to brick-layers and check height of courses all over the brickwork from time to time so as to keep the courses level. Clean each day's work before finishing day's work. Leave out only headers to allow put log to be inserted and do not leave more than one brick for each put log.

Any space between brickwork and slabs/beams above shall be filled with PCC 1:2:4.

d) Jointing concrete and brickwork

Where vertical faces of concrete and brickwork abut, roughen about 40% of the concrete surface by hacking or other approved means; clean the surface thoroughly and moist it for 24 hours before laying brickwork. Drill holes in concrete at 600mm centres vertically and install ties with Fisher plug unless shown otherwise in drawings. Embed wall ties in mortar bed joint of brickwork.

- e) **Uniting leaves of cavity walls**
 Unite leaves of cavity walls by wall ties embedded in the mortar, at the time the course is laid, to a minimum depth of 50mm. In non-load bearing brickwork, use ties at intervals of not more than 900mm horizontally and not more than 450 mm ventrally. In load bearing brickwork, the spacing shall be as tabulated below:

Least leaf thickness (one or both)	Cavity Width (mm)	Spacing of ties	
		Horizontally (mm)	Vertically (mm)
75 or more	50 – 150	450	450
90 or more	50 – 150	900	450

Ties shall be staggered and evenly distributed. Clean any mortar droppings on the ties or cover the ties with polythene in the cavity portion.

- f) **Removal of efflorescence**
 Remove efflorescence as specified in section 6.1 - of this Specification.

8.6 PROTECTION AND CURING

Protect all brickwork during construction from the effects of sun, rain and frost, by suitable covering if necessary in the opinion of the Engineer, and keep brickwork moist for a period of ten days.

8.7 EXECUTION OF WORK OF FAIR FACE BRICK WORK

Comply with the requirements of 3.1.6 and 3.1.7 except that use fair face bricks selected from first class bricks and lay the brickwork with extra care.

8.8 MEASUREMENT

- a) No deductions shall be made for the following:
- Voids (openings) not exceeding 0.10 m² (1 Sft) area in elevation.
 - Fire place flues.
 - Chases, pipes and embedded items.
- b) Deductions for string courses, sills, lintels, plates and the like shall be made as regards height to the extent only of full brick courses displaced.
- c) No deduction or addition shall be made on any account for ends of dissimilar materials like joists, beams, girders, rafters, purlins, trusses, corbels, steps etc, not exceeding 450 sq. cm (0.5 sq.ft) in section.
- d) In cavity walls, the width of the cavity shall not be included in the thickness of the wall.
- e) **Pay Items**
 Payment shall be made only for the pay items applicable to this Contract as

listed in the Bill of Quantities. Thicknesses of walls for payment shall be as stated in the pay items irrespective of the actual size of bricks approved. Pay item numbers and units for rates shall be as designated in the Bill of Quantities.

Pay Items	Description	Unit for Rate
-	Provide and lay first class brickwork in foundations and plinth in cement sand mortar of indicated ratio: (a) 228mm (9") and over thick (b) 114mm (4.5") thick	m3/Cft. m3/Cft.
-	Provide and lay first class brickwork in superstructure: (a) 228mm (9") and over thick in cement sand mortar of indicated ratio. (b) 114mm (4.5") thick in cement sand mortar of indicated ratio (c) 75mm (3") thick in cement sand mortar of indicated ratio	m3/Cft. m3/Cft. m3/Cft.
-	Provide and lay fair face brickwork, any thickness, in cement sand mortar of indicated ratio; (a) In plinth (b) In superstructure	m3/Cft. m3/Cft.

8.9 Payment

All the items of work covered by this Section of the Specifications shall be paid for at the unit rates entered in the Bill of Quantities and in accordance with the applicable terms and conditions of the Contract.

SECTION - 9

9.0 PLASTERING

9.01 Scope of Work:

The work covered by this section of the Specifications consists of furnishing all plant, labour, appliances, and materials and in performing all operations in connection with the installation of plastering complete in strict accordance with this section of the Contract.

9.02 General

Except as may be otherwise shown or surfaces specified all plaster surface shall include walls, partitions jambs, returns, reveals, backs of recesses and jambs and heads of windows and doors and all the soffits, alcoves unless otherwise specified or shown on the drawings.

9.03 Materials:

- a) "WATER" as specified in respective section.
- b) "CEMENT" shall be ordinarily Portland Cement and shall conform to B.S.S.12.
- c) "SAND" shall be from approved source and free from dust and salt as specified in Section on concrete.
- d) "METAL LATH" shall be expanded metal not less than 9" wide strips, and weighing at least 2.5 lbs, per square yard or as directed by the Engineer.
- e) "CORNER LATH" shall be strips 6" wide bent to form two 3-inches wings.
- f) **Lime:** (To be used for putty)
 - i. Hydrated lime shall conform to British Standard BS-890 Class A, with the further requirement that the total free (unhydrated) calcium oxide (CaO) and magnesium oxide (MgO) shall not exceed 8 percent by weight, calculated on the "as received" basis.
 - ii. Quicklime (pulverized) shall conform to British Standard B.S.890 A. Pulverized quicklime shall pass a No.20 sieve, and at least 90 percent shall be used throughout the work. After slaking to a putty, the pulverized quicklime shall have a plasticity figure of not less than 200 when tested in accordance with ASTM Standard methods of Test C 110, and at the end of 72 hours the total free (unhydrated) calcium oxide (CaO) and magnesium oxide (MgO) in the hydrated product shall not exceed 8 percent by weight, calculated on the basis of the lime solids in putty.
- g. **Lime Putty** shall be made from hydrated lime, except that quicklime may be used when adequate time and facilities are available for aging. Suitable precautions shall be taken to protect the putty from exposure to the sun and to prevent excessive evaporation when stored. Lime putty prepared from quicklime shall be allowed to cool completely before using. Lime putty shall be prepared as follows:

- i) Quick lime (pulverized) shall be slaked in suitable large batches, and with enough water to form a thick cream. During cold weather, precautions shall be taken to maintain the heat and prevent premature cooling during the process of hydration. The slaked quicklime shall be passed through a No.10 sieve and stored for at least 72 hours before using. When the use of lump quicklime, slaked on the job, in lieu of pulverized quicklime, is specifically approved for plastering, the cooling and aging period shall be not less than 14 days.
- ii. Hydrated lime shall be machine-mixed with water to form putty and shall be allowed to stand for at least 15 minutes before using.

9.04 MIXING OF MORTAR

Except where hand-mixing of small batches is approved by the Engineer, mechanical mixers of an approved type shall be used for the mixing of mortar. Frozen, caked, or lumped materials shall not be used. Mechanical mixers, mixing boxes, and tools shall be cleaned after mixing each batch and kept free of mortar from previous mixes. Plaster mortar shall be thoroughly mixed with the proper amount of water until uniform in colour and consistency. Retempering will not be permitted and all mortar, which has begun to stiffen, shall be discarded. Mortar for scratch coats over metal lath shall be fibered by the addition of a pound of hair or fibre per bag of cement.

9.05 PROPORTIONING OF PLASTER

- a) All plaster shall be Portland cement plaster, all coats of which shall be mixed in the following proportions by volume or otherwise specified.
One part cement
4 parts sand
1/4 part lime putty, if required or specified.
- b) All coats of plaster in liquid retaining structures shall be water proofed by the addition of an approved compound in liquid or solid form used at the approved rate. The water proofing compound shall be commercially pure with no grease or oils or other ingredients detrimental to the cement.

9.06 APPLICATION OF PLASTER:

- i) Strips of metal lath shall be provided between ceiling beams, lintels walls, columns and near by partitions of masonry parallel to the beams if required. The lath shall be laced with the wire at joints between sheets and screwed to the concrete and masonry with galvanized offset head or hood head lath nails. Also lath not less than 3" wide shall be installed over joints between dissimilar base materials where the surface to be plastered by in the same plane and where the base materials can not be effectively bonded or tied together.
- ii) Before the plaster work is commenced it shall be seen that all electric conduits, drainage and sanitary pipes inlets, outlets to tanks, brackets,

clamps doors and windows frames and all sorts of inserts are fixed in position. It shall be the responsibility of the Contractor to bring to the notice of the Engineer if such work is not carried out by the other Contractors. Chiseling and repairing of cement plaster shall not be permitted under any circumstances.

- iii) The walls shall be washed with fresh water and shall be kept damp for 2 hours before the plaster is applied. All masonry joints and concrete surfaces shall be properly roughened before plaster work is commenced. The proportion of cement plaster shall be as per drawings or as specified. The ingredient shall be properly mixed. The sand used for mix shall be only sufficient for one bag of cement. The mixtures shall be turned over and over till the ingredients are thoroughly mixed. Cement slurry shall be applied to the surface to be plastered and allowed to dry before plaster work is commenced.
- iv) The plaster shall be from 1/2" to 3/4" thick and shall not be less than 1/2" thick at any surface. If the plaster is more than 3/4" thick it shall be done in two coats, the first coat shall be made rough. The plaster on all surfaces shall be perfectly in plumb. The edges and corners shall represent a straight line. The plaster shall be kept wet for at least 10 days. No extra payment shall be allowed for jambs, junctions, corners, edges, round surfaces, cement slurry base and for thicker plaster required due to any un-evenness in the work done by the Contractor. At edge of every horizontal projection on external faces of the building if directed by Engineer a drip course of 3/4" is to be provided for trickling of water without any extra cost. Plaster on lath shall be done in three coats. Finish coat shall have a reasonably uniform thickness of approximately 3 mm (1/8"), and the minimum thickness at any point shall not be less than 1.5 mm (1/16") and shall be applied in one continuous operation without staging breaks.
 - a) The Scratch Coat: shall be full and thick and shall be applied with sufficient force to form good keys. The scratch coat shall be cross-scratched upon attaining its initial set and shall be kept damp with a fog spray.
 - b) Brown Coat: shall be applied after the scratch coat has set, but not earlier than 24 hours after the application of the scratch coat. When applied directly to masonry, the brown coat similar to the scratch coat shall be applied with sufficient pressure to fill the raked-out joints in brickwork to prevent air pockets and secure a good bond. The brown coat shall be lightly scratched and broomed after attaining its initial set and shall be kept moist with a fog spray for 2 days and then be allowed to dry out.
 - c) Finish Coat: shall not be applied until the brown coat has seasoned for 7 days. Just before the application of the finish coat, the brown coat shall be wetted evenly with a fog spray. All plaster shall be given a sand float finish of a uniform texture as approved or directed otherwise by the Engineer or his Representative. The finish coat shall be kept moist with a fog spray for at least 7 days and thereafter shall

be protected against rapid drying until properly and thoroughly cured and dried.

9.07 SAMPLING OF PLASTER

Samples may be taken by the Engineer at any time from plaster work in place. Areas where over sanding is observed shall be rejected and shall have to be done again at the cost of contractor.

9.08 DRIPS AND GROOVES:

The Contractor shall make drips for rainwater protection and Architectural grooves shall also be made as shown on the drawings or directed by the Engineer.

9.09 ALIGNMENT AND SMOOTHNESS

All cement plaster shall be uniformly true in line level and plumb, smooth trowel finished, free of waves and blemishes etc; to the full satisfaction of the Engineer or his Representative.

9.10 CLEANING AND PROTECTION

Rubbish and debris shall be removed as necessary to make way for work of other trades and as directed by the Engineer or his representative.

As each room or space is completed all rubbish, debris, scaffolding and tools should be removed to leave the room clean.

Protect finished plaster from injury by any source.

Prior to plastering all Aluminium windows and finished metals should be covered by sheet of plastic or tarpaulin to protect it from damage.

Contractor shall also protect walls, floors and work of their trades from plaster materials.

9.13 PAYMENT

Plaster work will be measured and paid for the net area over which it is laid. All openings shall be deducted. The cost for drips and architectural grooves shall be included in the unit rate of plaster and no separate payment shall be made for drips and grooves.

SECTION - 10

10.0 FLOORING

10.01 Scope of Work:

The work covered under this section of the Specifications consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations in connection with the construction of floors complete as details of floors in strict accordance with this specification and the schedule of finishing, the applicable drawings and subject to the terms and conditions of the contract.

10.02 Before commencing any work under this section the Contractor shall study applicable drawings, schedule of finishing, details of floors, all levels etc. the Contractor shall also ascertain before starting of flooring that all pipes, trench etc. to pass under flooring have been placed in position and tested. Other concerned trades shall be consulted for completion of all required utilities prior to commencement of the work.

10.03 Sub-Grade

All sub-grade shall be prepared to the lines, levels and falls as indicated on the drawings, all subgrade should be compacted mechanically to obtain a density as specified. All sub-grade shall be inspected and approved by the Engineer before any subbase is placed on it.

10.04 Material:

- i) Water
As specified in the relevant Section of the Specifications.
- ii) Cement
 - a) The grey cement shall be ordinary normal setting cement of any brand complying in all respects with B.S. No.12.
 - b) White cement shall be complying in all respects with British Standard.
- iii) Concreting:
All classes of concreting, "B", "C", "D" or "E" shall conform to their respective specifications as laid down in Section on "Concrete".
- iv) Terrazzo Cast-in-Situ:
 - a) The Contractor shall lay 1/2" thick terrazzo topping with white cement or grey as specified and use marble chips No.1 to 4 of approved colour and quality and shall have an abrasive hardness of not less than 16 as determined by the test of wear resistance in national bureau of Standard Report BMS-98. The various sizes of chips shall conform to following:

Chips size No.	Passing through Screen inches	Retained in Screen inches
-----	-----	-----
1	1/4	1/8
2	3/8	1/4
3	2	3/8

4

5/8

½

Chips shall be crushed so that all the dimensions are close to the limits of the specified sizes. Flats or flaky chips shall be kept to a minimum. Colour of the chips shall be selected by the Engineer if the chips are not clean, the Engineer's Representative reserves the right to have them washed at the cost of the Contractor. Terrazzo topping shall be laid over concrete surface as given on the drawings and the ratio shall be 2 part of chips and one part of cement by volume.

b) **Division Strips**

Division strips shall be 1 1/2" wide strips of 5mm thick plate glass and will be suitably embedded and anchored. Division strips shall be fixed on the terrazzo in situ pavements on 4' x 4' grid, unless otherwise shown on the drawings or directed by the Engineer.

vi) **White/Black Glazed Tiles:** (Skid or non-skid)

6"x6"x1/4" or any other size as directed by the Engineer shall be best quality glazed tiles of manufacturer as approved by the Engineer.

10.05 Method of Application:

i) Terrazzo Cast-in-Situ:

The terrazzo shall be machine grinded to a true even surface using a No.24 grit followed by a No.80 grit or finer abrasive stone. After the first grinding, the floors shall be thoroughly grouted with the same cement and colour composition as specified for the matrix of the terrazzo mix. The grout shall be of the consistency of thick cream, and shall be brushed over the floor to eliminate all cavities and thoroughly fill the surface for final grinding.

Not less than 72 hours after application, the grouting coat shall be removed by grinding. In the later stages of grinding the grit stones or other abrasive used in the grinding machine shall be of a grain or fineness that will give the surface a honed finish. Small areas, inaccessible portions and corners, which cannot be reached by the grinding machine, shall be ground and rubbed manually. After all grinding is completed the surface shall be polished to the entire satisfaction of Engineer or his Representative.

10.06 Terrazzo Tile Flooring:

a. General:

Terrazzo tiles of specified size and thickness made to the best local standard with best quality marble chips '0' to maximum of 3 No. size with white/grey cement and colour and pattern as approved by the Engineer on his Rep. shall be used for all floors except otherwise specified. Tiles shall be laid on a bed of cement-sand mortar of ratio not less than 1:6 and the mortar shall be covered with neat cement slurry and the joints of the tiles shall be kept perfectly tight and grouted with the cement of same colour as that of the matrix of the terrazzo tiles. Tiles shall be laid evenly and to the perfect level

and shall be set between the walls of the room so as to cause minimum cutting of the full size tiles and where the tiles do not "Corner-out-even" the excess space area, joints pattern shall be continued throughout the floor.

Tiles shall be cured for a minimum of seven days after casting Terrazzo tiles shall be made of grey cement, white cement or a combination of two and to match sample for tiles available in the office of the Engineer. The joints shall not exceed 1/16 inch in any case and shall be rendered invisible as far as possible in colour with cement to match the tile colour. The joints shall be perfectly straight and shall meet perfectly with the lines of adjoining rooms. All terrazzo tiles shall be the product of reputable tile manufacturers and shall be cast and pressed Hydraulically in machines especially made for the manufacture of Terrazzo tiles. The machines used and method of manufacture shall be subject to the approval of the Engineer or his Representative. The minimum thickness of Terrazzo Matrix on top shall not be less than 1/2 inch thick in any part of the tiles. Tiles with Terrazzo Matrix less than the thickness stated above shall be rejected and the Contractor shall have to replace the tiles at his own cost and risk. Contractor shall, before bringing the tiles ensure that these conform to the specifications with regard to their colour and size of Marble Chips. All rejected tiles shall be immediately removed by the Contractor from the site. All Terrazzo tiles shall be wax polished before acceptance.

- b) Chequerred Tiles:
Chequerred Terrazzo tiles for staircase and other specified locations shall be made to the same specifications as terrazzo tiles as specified in this Section. The exposed edges of Terrazzo tiles on steps shall have a Terrazzo Matrix on one edge of the tiles. The exposed edge shall project 1" from the finished face of the riser as shown on the drawing. Chequerred tiles shall be subject to the approval of the Engineer or his Representative. The tiles shall be 1" thick and the Terrazzo Matrix shall not be less than 1/2 inch.
- c) Polishing & Finishing:
Complete curing, initial grinding or cutting and finishing of the tiles shall be done prior to the delivery on the site. All Terrazzo floor tiles shall remain in place after setting for not less than 1 (one) week unless otherwise approved. Final grinding, cleaning and polishing shall be done to the best standard and upto the satisfaction of the Engineer or his Representative.
- d) Curing:
All Terrazzo floors and finishes shall be cured for a minimum of 7 days after laying by means of wet bags or sand or other approved methods.
- e) Defects in Tiles and Tile laying:
The surface of all tiled floors shall be perfectly as per level and grade as shown in drawings or as directed and shall be executed by experienced workers in the field of Tile laying. A sample Panel of laid Tiles of each type shall be got approved by the Engineer or his Representative before

commencement of the laying. All chipped or damage tiles installed by the Contractor shall be rejected and shall have to be replaced by the Contractor at his own cost and risk.

f) Wall Bases: (Skirting)

Wall bases where specified in all areas with Terrazzo shall be as shown on drawings. All wall bases shall be made with cast-in-situ Terrazzo and the colour and size of marble chips used shall be such as to match with the terrazzo tile floors in each room or area. The minimum thickness of Terrazzo Matrix shall not be less than 1/2" thick. The height of wall bases shall be as shown on the finish schedule and the relevant drawings. The surface shall be perfectly smooth and polished to a high degree of finish. The top edge of wall base shall be perfectly straight. Sample of each type of wall bases shall have to be approved by the Engineer or his Representative before commencement of work of wall bases by the Contractor. All applicable Specifications pertaining to Terrazzo cast-in-situ as laid in this Section shall be applicable for cast-in-situ wall bases. All tiles shall be laid before the work of wall bases is started and no cast-in-situ Terrazzo of wall bases shall be allowed on the flooring to overcome defect in tile laying.

10.07 **Glazed Ceramic Tiles:**

Glazed tiles will be of size 6 inch x 6 inch or as directed by the Engineer and of best quality of local manufacturer white/colored shall be supplied by the Contractor. All sanitary and water supply pipes shall be in place before start of glazed tiles work.

The walls and floors on which the glazed tiles are required to be fixed shall be plastered with 1:4 cement mortar 1/2"-3/4" thick as base for the tiles and surface shall be thoroughly roughened. Before starting to fix the tiles the plaster shall be thoroughly wetted and cement slurry spread on the surface. Neat cement mixed with water in the form of thick paste shall be uniformly applied on the tiles-back and the tiles pressed on the wall so as to spread the cement paste uniformly under the tiles. The squeezed out slurry shall be wiped out of the edges. The tiles shall be laid course after course starting from bottom. No joint shall be more than 1/16" and all joints shall be uniform and continuous. The slurry shall be gently raked out from the joints when it is green. White or coloured cement of the same shade as tiles shall be applied in the raked out joint and finished slightly sunk with the tiles surfaces.

10.08 **Marble Tiles in Flooring, Skirting, Dado and Steps**

a. Material

Marble for use on the building shall be selected first quality marbles of type and colour as specified by the Engineer or his Representative marble shall be the best quality China Verona marble free from discolorations.

Anchors and Cramps shall be made of non-ferrous metal as detailed on the drawings and specified and directed.

Cement shall be white Portland cement meeting with the requisite British Standard Specifications.

Coloured marble shall be other than dark Green onyx marble.

Green Onyx: Where specified best quality of dark green marble shall be used meeting with the approval of the Engineer.

- b. Samples:
Samples of all types of marble for various areas shall be got approved by the Engineer or his Representative. Contractor shall have to match the marble brought to site as close to the approved samples as possible. The Engineer or his Representative has the right to reject marble pieces, which have unduly dark patches, or large unsightly veins which do not conform to the overall pattern and effect on the marble wall. Contractor shall also construct a Panel for each of the marble areas for the approval of the Engineer or his Representative before commencement of work. Engineer's discretion with regard to quality of marble shall be final and binding on the contractor.
- c. Workmanship:
The size of marble slabs and the jointing pattern shall be as shown on the drawings or as directed by the Engineer or his Representative. Joints between the marble slabs shall be filled smooth with white cement paste of the required shade of the marble slabs. The marble slabs before being laid shall be machine cut, dressed smooth and mirror polished and shall be free from cracks or any other discolorations, which in the opinion of the Engineer or his Representative is objectionable. All such defective and rejected marble slabs shall have to be replaced by the Contractor at his own cost and risk. The thickness of marble slabs shall be as specified.
- d. Selection of Marble:
The marble slabs shall be selected by the Contractor in the factory before these are brought to site for installation purposes which match the samples in the office of the Engineer. Marble pieces which do not meet with the approval of the Engineer or his Representative shall be removed and replaced by the Contractor at his own cost and risk, whether they have been installed or not.
- e. Installation:
Marble for floors, walls, shall be laid on a bed of mortar by workmen specialized in the marble work. All floors shall be perfectly level and joints rigidly conforming to the joint pattern. Any leveling of concrete floor or filling in of low spots by mortar for levelling shall be done by the Contractor at no extra cost to the owner. Wherever slope for drainage purposes is required the bed shall be pitched to slope. Marble slabs in walls and columns shall be properly anchored to the wall or column as well as between the slabs themselves by means of anchors and cramps as detailed on the drawings or as directed. Non-ferrous metal anchors and cramps shall be used. Anchors shall be rigidly bolted to the wall.
- f. Even Panels:
In each surface marble panels both horizontally and vertically shall be so divided that the sizes of all panels are equal. The sizes of panels in the pattern

shown on drawings may be adjusted in each room with the approval of the Engineer or his Representative in order to have all equal sized panels of marble.

Before cutting the marble pieces for each space the Contractor shall take actual physical measurements of the constructed portion so that even sized marble panels can be fitted at all places. Unequal panel sizes shall not be acceptable and shall be replaced at the cost of the Contractor. Joints between marble panels shall not be more than 1/16" and shall be filled in with white cement slurry as specified.

g. Kitchen Cabinet Tops:

Specially selected marble slab shall be used for counter tops as specified and directed. These marble slabs shall first be approved by the Engineer or his Representative before actual cutting and installation of marble slabs is undertaken. Counter tops upto 3'- 0" length shall be one piece marble slabs and for over 3'-0" long counters two marble pieces shall be used to obtain the required length of the counter. The cutting of holes in slab for sink and water taps where required shall be accurately done according to the actual size of sink and piping. The Contractor shall coordinate this work with the sanitary contractor. Marble slabs wherever indicated to be installed shall be mirror polished and finished before installation duly cut to the required size.

h. Finishing and Polishing:

All marble before being laid in the final position shall be finished and polished to a high degree of mirror finish by means of machine grinders in the factory. Where machine grinders cannot be used grinding and polishing by hand may be permitted by the Engineer or his Representative. All polished surfaces shall meet the approval of the Engineer or his Representative before acceptance.

10.08 **Cement Concrete Flooring:**

The materials for C.C. flooring shall be the same as already specified under other clauses of these specifications.

a. Composition of Concrete

Concrete shall be composed of Portland cement, sand, coarse aggregate and water, all well mixed and brought to the proper consistency. The Contractor shall mix the ingredients as shown on the drawings or as specified. The proportions of the various ingredients shall be determined from time to time during the progress of the work and tests shall be made of samples of the aggregates and the resulting concrete. The mix proportions and appropriate water cement ratio shall be determined on the basis of the production of concrete having required workability, density, impermeability, durability and required strength.

b. Mixing Concrete

The concrete ingredients shall be mixed in batch mixer for not less than 1 1/2 minutes after all ingredients, except the full amount of water, are in the mixer.

The Engineer reserves the right to increase the mixing time when the charging and mixing operations fail to produce a concrete batch in which the ingredients are not uniformly distributed and the consistency is not uniform. The concrete shall be uniform in composition or consistency from batch to batch except when changes in composition or consistency are required. Water shall be added prior to, during and following the mixer charging operations. Excessive over-mixing requiring the addition of water to preserve the required concrete consistency shall not be permitted. The concrete ingredients shall be mixed by volume in boxes made for this purpose and approved by the Engineer.

c. Construction

The base course of the floor shall comprise of stone in case of Car park garages and road pavement. The base course shall be thoroughly compacted by suitable power rammers to the total consolidated thickness as shown on the drawings and as approved by the Engineer. The interstices shall be filled with smaller size stones screened material with finer particles. The base course shall be blinded with sand and the whole surface watered. Over the well compacted base course, a layer of 1:2:4 concrete of the required class and thickness shall be laid in panels of the sizes as indicated on the drawings and as approved by the Engineer.

At places other than mentioned above, base course of required thickness and class of concrete shall be laid over a sub-grade compacted to 95% AASHTO density.

After the C.C. bed has been cured, as directed by the Engineer, it shall be roughened and well watered before floor finishing is laid. The floor finish shall comprise of cement concrete 1:2:4 nominal mix or of such proportion as specified or directed by the Engineer and of the required thickness shall be laid in alternate panels with butt joints to the required thickness as shown on the drawings and/or as directed by the Engineer. The concrete after laying will be thoroughly rammed and mortar worked up to the top and smoothed with a steel trowel. The edge of each section into which the floor is divided should be defined by wooden screeds of the approved width and of a depth equal to the depth of floor concrete.

Freshly placed concrete floor portions as finished shall be protected to prevent loss of water by covering with damp hessian, waterproof paper, or other approved material, and shall be kept constantly damp for a period of 10 days or longer after concreting, as directed by the Engineer. The concrete shall be allowed to dry out slowly over a period of a few days after wet curing is completed.

10.09 Measurement and Payment:

All the items of work covered by this Section of the Specifications shall be measured by the Standard Method of measurements. The quantity of flooring will be ascertained by measuring length and breadth of actual area laid deducting any

section of columns and other structures penetrating throughout the floor and shall be paid for at the individual item rates entered in the Bill of Quantities and in accordance with the applicable terms and conditions of the Contract.

SECTION - 14

14.0 FALSE CEILING

14.1 SCOPE OF WORK:

The works covered by this section of the specification consist of furnishing all plant, labor, equipment and materials and in performing all operation in connection with provision and installation of the False ceiling and related works, wherever required as per drawings, specification and as directed by the Engineer.

14.2 GENERAL:

Acoustical ceiling work shall be installed wherever indicated on the drawings or instructed by the Engineer. Shop drawings showing the mechanical suspension system, disposition of ceiling units to present form or pattern as approved and also showing the required grooving wherever required, details of molding at wall junctions at the periphery and other details shall be prepared by the Contractor within the rate of the item of the agreement the contractor shall get the shop drawings approved by the Engineer before undertaken this item of work.

14.3 MATERIALS:

a. Hangers:

The Hangers shall be of MS Flats as per standard suspenders supplied for Acoustic ceiling. All hangers, if not factory painted shall be painted with one coat of red lead paint and two coats of approved quality enamel paint. It is the responsibility of the Contractor to get the sample of hanger approved by the Engineer before using the same in the works.

b. Suspension Frames

These shall be the standard frames as provided by the manufactures for Acoustic ceiling with perforated aluminum units. Surface stove enameled and including mineral wool infill and glued black tissue paper inlay. Access panels and light fitting recesses shall be provided as required at site.

c. Acoustic Tiles of approved size manufactured from Boral Plastic Board gypsum board.

14.4 INSTALLATION AND WORKMANSHIP

Suspension System

The hanger as specified shall be evenly placed in position as indicated in drawing details, at the time of concreting of RCC roof and beams. Their lengths shall be properly adjusted to maintain the horizontal surface of the false ceiling. Wooden framing shall be nailed to these hangers for fixing acoustical tiles and light fixture over it. The jointing of Deodar wood battens to hangers shall be as per approved shop-drawing details. Acoustical tiles shall be a sound absorption co-efficient of 0.67 at 500 cycles per second (CPS).

14.5 FINISHING

After installation, dirty, soiled or discolored surface shall be cleaned up left free from defects and ready to receive any painted finishes, if required.

14.6 MEASUREMENT AND PAYMENT

Unless otherwise specification stated in the Bill of Quantities or herein, all the work involved within scope of this section of specification shall be deemed to be inclusive of but not limited to the following:

- i) Contractor's establishment charges, over head charge, profit, interest.
- ii) All other expenses, charges, taxes specification in Condition of Contract.
- iii) Labor and all costs in connection there- with.
- iv) Use of plant, equipment and machinery and all costs in connection therewith e.g. mobilization, demobilization, transporting, fuel, energy charges, grease, oil, installing, operating, storing, watching, returning, handling, maintaining, idle stand parking, removing damaged, destroyed, salvaged items.
- v) Material and goods e.g. marketing, selecting. Conveyance, loading, unloading, storing, watching, returning, handling, hoisting, lowering, cutting, jointing, fixing, wastage, removing damaged, destroyed, salvaged material.
- vi) The cost of all laboratory and field tests including sampling stipulated in these specifications.

The Cost of all works involved within the scope of this specification as per all the contract are covered only within the quoted rate of items of the BOQ.

Measurement for payment shall be made on the basis of the superficial area in sq.ft / Sq.mt. of false ceiling fixed in position and the work to be done shall include providing and fixing of hangers, battens, tiles, paints, labor etc. all complete in every respect as shown on the drawings, and to the entire satisfaction of the Engineer.

SECTION - 16

16.0 ROOF TREATMENT

16.01 SCOPE:

The work covered by this section of the specifications consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations in connection with the execution of the work of roof treatment complete, in strict accordance with this section of the specifications and the applicable drawings and subject to the terms and conditions of the contract.

16.02 MATERIALS:

- a) Cement, aggregate and coarse sand shall be in accordance with the specifications for "Concrete".
- b) Clay tiles (Manglore Tiles) as approved by the Engineer.
- c) Samples of all materials proposed for use under this section shall be submitted to the Engineer for his approval.

16.03 APPLICATION

After all the surface to be treated has been broomed, and cleaned, a 2" (50 mm) thick average screeding with cement concrete 1:2:4 shall be laid over R.C.C. roof slabs in alternate panels as approved by the Engineer. The screed shall be finished in proper slope and level and shall have smooth finish.

After the concrete of screed has been cured and has set and dried, it shall be cleaned thoroughly to ensure that it is free from dirt, sand and Grease etc. Roof Clay Tiles of red colour approved by the Engineer shall then be placed on the roof and grouted with cement mortar.

16.04 MEASUREMENT AND PAYMENT:

Works shall be measured net acceptably completed and as applied in position conforming to the drawings and the instructions of the Engineer.

Unit rate for the Roof treatment work shall be deemed to be inclusive of all detail of this item mentioned in the BOQ (Roof Screeding, Water Proofing Membrane with primer, polystyrene and preparatory works, like scrapping, scratching, cleaning, etc . complete as per drawings, specifications and direction the Engineer.

SECTION - 17

17.0 PAINTING, DISTEMPERING AND WHITE/COLOUR WASHING ETC.

17.01 SCOPE OF WORK:

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 steel works, steel and wooden doors, windows, ventilators, walls ceilings and all such surfaces as shown on the Drawings and/or as directed by the Engineer. The scope of this section of specifications is covered with detailed specifications as laid down herein.

17.02 GENERAL:

Except as otherwise specified, all painting shall be applied in conformity with BS CP 231 "Painting of Building as applicable to the work".

The Contractor shall repair at his own expense all damaged or defective areas of shop-painted metal 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.

Except as otherwise specified, all concrete and plastered surfaces are to be painted.

17.03 MATERIALS:

All materials shall be acceptable, proven, top-grade products and shall meet or exceed the minimum standards of reputable manufacturers as approved by the Engineer.

Colors shall be pure, non-fading pigments, mildew-proof, sun-proof, finely ground in approved medium. Colors used on plaster and concrete surfaces shall be lime-proof. All materials shall be subject to Engineer's approval.

All enamel paints and primers for wood and metal work will be the best available of its type and shall be approved by the Engineer prior to its procurement.

Unslaked lime, gum and marine blue shall be used for white washing.

DUROCEM a cement base heavy duty water proof coating manufactured by ICI or any equivalent approved by the Engineer shall be used for painting on the surface specified. The cement base water proof coating for concrete shall conform to ASTM C-109,C-67, D-822 and G-23.

All materials shall be delivered to site in their original unbroken containers or packages and bear the manufacturer's name, label, brand and formula and shall be mixed and applied in accordance with his directions.

17.04 SURFACE PREPARATION:

All oil, grease, dirt, dust, loose mill, scale and any other foreign substance shall be removed from the surface to be painted, polished and white washed 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 Engineer.

In the event the surface becomes otherwise contaminated in the interval between cleaning and painting, recleaning will be done by the Contractor at no additional cost.

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.

No work in this Section shall be allowed until all surfaces or conditions have been inspected and approved by the Engineer.

17.05 APPLICATION:

All paint and coating materials shall be in a thoroughly mixed condition at the time of application. All work shall be done in a workmanlike 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 Engineer paint shall not be applied when the temperature of the surrounding air is below 10 Deg.C. 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 measures shall be taken to prevent segregation of the paint in the container during painting operations.

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. Surfaces to be painted that will be inaccessible after installation shall be completely painted prior to installation shall be completely painted prior to installation.

Only as much material should be mixed as can be used up in one hour. Over-thinning 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 overnight.

All steel doors, windows and ventilators shall be painted with two coats of approved enamel paint over one coat of a redoxide primer as directed by the Engineer.

Oil bound distemper shall be applied to internal wall surfaces and white wash on ceilings as specified herein after.

For applying Durocem the surface shall be dampened with clean water immediately ahead of application. Durocem and clean water shall be mixed as per directions of the manufacturer. A heavy first coat at 20 lbs/100 sft (1 kg per sq.m) shall be applied. This shall be followed by a second brush coat at 10 lbs/100 sft (0.5 kg per sq.m) after the first coat has set. When finish coat has set, it shall be floated to uniform texture with a sponge float. The work shall include cleaning the surface, sand papering and smooth finishing, scaffolding, curing etc. complete as per the approval of the Engineer.

17.06 WHITE AND COLOUR WASHING:

The surfaces shall be well cleaned and brushed before white washing. The white washing material shall be prepared from un-slaked lime. The lime shall be dissolved in a tub with sufficient quantity of water and then well mixed and strained through a clean cloth. 4 kg clean gum boiled with 12 kg of rice for each cu.m of lime shall be added to the liquid lime along with a small quantity of marine blue as directed by the Engineer.

The mixture shall be in thoroughly mixed condition and shall be applied in three coats with a brush.

Each coat of white wash shall be allowed to dry, so that no sign of cracking shall appear on the surface and also white wash shall not come off readily on fingers when rubbed. The white wash when completed, shall form an opaque coat of uniform white colour, through which the old work does not show and shall present a smooth regular surface free from Powderly matter. For colour washing approved quality of coloring matter shall be added to the liquid and thoroughly mixed by stirring.

17.07 DISTEMPERING:

Oil bound distemper of approved quality and shade shall be applied on internal wall surfaces where shown in drawing or directed by the Engineer.

17.08 EXECUTIONS:

17.09 SUBMITTALS

Colour samples shall be submitted on 6"x6" (150x150 mm) asbestos cement boards, showing each type of paint for Engineer's approval.

17.10 PRODUCT DELIVERY

Deliver materials in manufacturer's original unopened containers with labels intact and legible identifying brand names and contents.

17.11 JOB CONDITION

Observe manufacturer's recommended minimum and maximum temperature but do not apply paint or finish to any surface unless ambient temperature is 10 deg.C or above and less than 43 deg.C. No painting shall be done above 90% relative humidity.

Place drop cloths to adequately protect all finished work.

Remove and replace all items of finished hardware, device plates, accessories, including fixtures or other removable items.

The surface shall be prepared first before applying distemper by filling depressions with putty, rubbing, sand papering and cleaning. A priming coat shall first be applied of petrifying liquid of approved manufacture. Distemper shall be applied with broad stiff brush of approved make. Distemper shall be applied quickly and boldly. Each coat of distemper should first be got approved by the Engineer before applying the next coat.

17.12 MEASUREMENT AND PAYMENT:

Measurement of the work acceptably completed and specified herein as painting, distemping, and white/colour washing etc. will be made on the basis of actual area in square feet of the respective job including all preparatory work like scraping, scratching, sand papering, filling depressions with putty, priming and scaffolding etc. complete in all respect as directed by the Engineer. Payment under covered in this section shall be made as per unit rates entered in the BOQ. No payment shall be made for painting work on doors, windows, ventilators, steel grills, cabinets and cup boards steel ladders etc. for which the contractor shall make necessary allowance in his rates for such items.

SECTION - 18

18.0 COLOUR CREATING / SNOW CREATING

18.01 MATERIAL

Cement shall be of specified colour and approved make and shall conform to the latest specification for Portland cement. If cement of approved shade is not available the contractor may be allowed to make the coloured cement by mixing approved pigment.

18.02 Marble chips of approved quality shall be of the colour or colours mixed in particular proportion as specified in the schedule of quantities; and where it is not so specified these will be provided as per direction of the Engineer-in-Charge. The chips shall be of zero number unless otherwise, directed.

18.03 The marble powder shall be free from all dust and dirt and shall be of approved quality.

18.04 PREPARATION OF SURFACE

The surface of over which the colour create / Snow create is to be applied shall be well-hacked or roughened to form a mechanical bond. The surface must be well soaked with water. The water should be allowed absorbed into the surface to be rendered and the first coat applied when there is just a slight amount of moisture left on the surface. The thickness of the base coat shall be as specified in the schedule or quantities. The finishing cont of Colour create / Snow create shall be applied 48 hours after, applying the base coat.

18.05 The first coat shall be composed of ordinary Portland cement and sand in the proportion specified in the schedule of quantities. The coat shall be well pressed and deeply secured to the surface. The surface shall be well combed to provide at key for the following coat.

A minimum of 48 hours should elapse before the finishing coat is applied.

18.06 It shall be composed of marble chips, marble Powder and Snow create / Colour create / cement mixed with Pigment, in the specified proportion. Before applying the finishing coat the surface should be sufficiently wetted.

Where provided in the schedule of quantities grooves *or* required dimensions shall be made with special tools all over the surface to sub-divide it into blocks of the shown in the drawing or as directed by Engineer-in-Charge. The grooves must be uniform in depth and width throughout being taken out in the approved shape. The grooves must run horizontally and vertically to be exactly parallel and / or perpendicular to each other unless otherwise specified.

Where required in the schedule of quantities the surface of Snow creates Colour create shall be chiselled in an approved manner with sharp tools as directed by the Engineer-in Charge.

18.07 The surface must be cured for a period of 7 days in a suitable manner approved by the Engineer-in-Charge.

18.08 **MEASUREMENT AND PAYMENT:**

Measurement and Payment under covered in this section shall be made as per unit rates entered in the BOQ.

SECTION - 19

19.0 STEEL WINDOWS, VENTILATORS, GATES AND GRILLS.

19.1 SCOPE OF WORK:

The work covered by this section of the Specifications consists of furnishing, transporting and storing all plant, equipment, appliances labour and material and in performing all operations in connection with the fabrication, welding, erecting and painting of steel units complete in strict accordance with the drawings and/or as directed by the Engineer.

19.2 MATERIALS:

All materials shall be new of the best standard commercial quality and shall be approved by the Engineer.

All the angles, squares, sheets and channels etc., shall conform to BS 4360.

19.3 CAST IRON:

Cast iron should of good grey metal, sound, free from all flaws such as pitting due to impurities or sand from the pattern, cold shuts (i.e., irregularities due to casting at too low temperature, blow-holes etc.). It should have a clean smooth surface, true to pattern.

19.4 WROUGHT IRON:

Wrought iron should be of good tough metal with an even silky fibrous grain which will be apparent if twisted and bent. A good iron must be neither cold short (i.e., brittle when cold due to production from and inferior core) nor hot short (i.e., a tendency to cracking at the surface edges when working at red hot due to the presence of sulphur).

19.5 DRAWINGS:

The Contractor shall prepare all necessary shop and erection drawings covering the steel to be furnished under these Specifications. No fabrication and erection shall be taken in hand until these drawings have been approved by the Engineer.

All work under this section shall be coordinated with the work to be done as specified under other sections of the Specifications.

The Contractor shall drill, tap, cut and fit the work included herein as required, to accommodate work of other trades in conjunction with it.

The Contractor shall furnish all information and instructions required for work by other trades.

Samples of material specified shall be submitted for approval when required by the Engineer.

19.6 FABRICATION:

All work shall be equal to the best modern practice in the manufacture and

fabrication of structural steel notwithstanding any omission from these specifications or Drawings. All fabrications shall conform to BS-449.

Before being laid out or worked in any way, the steel shall be straight and free from kinks and bends. If straightening is necessary it shall be done by methods that will not injure the metal. Shearing and cutting by torch or electric shall be performed carefully, and all portions of the Work which will be exposed to view after completion shall be finished neatly.

All holes shall be cylinder, unless otherwise shown on the Drawings, perpendicular to the member and clean cut without burred or ragged edges. Holes in the material shall be drilled to full size and shall be accurately and carefully placed. The length of bolts shall be in 1/4 of an inch variation, and when in the steel gate, the bolts shall extend at least 1/4 of an inch beyond the nuts.

19.7 **WELDING:**

Welding shall be done by qualified and licensed welders under the supervision of expert fabrication Engineers. All the welding shall be executed according to BS 538.

All defective and damaged works shall be rejected at the sole risk and cost of the Contractor.

Where welding is required in the works as per drawings or as required by the Engineer, the welding shall develop the full strength of the adjoining steel.

19.8 **ERECTION:**

The method of erection and propping the gates, frames, windows and ventilators shall be according to the Drawings or as directed by the Engineer. The engineer shall inspect and approve all the equipment, temporary works and other measures proposed to be adopted for the erection and safety of the steel sections. The contractor shall be responsible for the safety of damage to any person or to any part of the building while the work is in progress.

All steel sections shall be accurately assembled and erected as shown on the Drawings, on the scheduled dates in complete harmony and coordination with the progress of other construction works in the building. All of the material shall be handled carefully so that no part will be bent, broken or damaged otherwise. Hammering that will injure or distort the members will not be permitted.

Prior to erection of the steel, all shoe plates, down holding bolts etc., shall be fixed / grouted dead accurate in levels and alignment as per details shown on the drawings or as directed by the Engineer.

19.9 **HARD WARE:**

All required hardware like handles, locking devices where required, stays and latches etc. for windows and ventilator shall be provided. Samples of all items of hardware, accessories and other items requested by the Engineer shall be submitted for his approval.

19.10 **GLAZING:**

Glass shall be as specified and shall be framed on all four sides. Glazing beads,

gaskets, glass adapters and glazing compound shall be provided as specified or approved by the Engineer.

19.11 STEEL GRILL:

Grill shall be of design and type shown in the drawings or of the pattern approved by the Engineer. M. S. Flats of approved size shall be welded to steel frame of similar section which shall be fixed/screwed to windows/ ventilator frames. Grills shall be installed on the inner or outer side of the frame as indicated and shall be painted with two coats of primer and three coats of approved quality enamel paint.

19.12 STEEL GATE:

Steel gate shall be manufactured of the type and design of steel grills described here-in-before. All the MS sections and plates shall be approved by the Engineer. Painting to gates shall be carried out after installation as described here-in-before.

19.13 CAULKING:

All fixed joints between various parts of windows and ventilator assemblies shall be buttered with caulking compound before the windows are assembled. All joints between windows and ventilators and surrounding masonry or concrete construction shall be caulked with approved caulking compound.

19.14 MEASUREMENT AND PAYMENT:

All the steel door, ventilators and gate shall be measured between top of the frame and finished floor level or bottom of frame vertically and between the outer edges of the frame horizontally and paid for at the unit rates entered in the Bill of Quantities and shall be inclusive of finishing hardware, glazing, painting etc. as specified and shown in drawings, complete in respects.

SECTION – 20

2.0 STRUCTURAL STEEL WORKS

20.1 SCOPE

This Section covers requirements of steels, steel work, fabrication, methods including precautions for erection of steel structures and other general requirements incidental to steel work.

20.2 GENERAL

The applicable requirements of this section as determined by the Engineer shall apply to all structural steel works under this contract. The work covered by this Section consists of all material, labour, plant, equipment and appliances including welding, bolts, nuts, washers, anchor bolts, embedded parts etc, fabrication and erection in accordance with the specifications and as per drawings and as directed by the Engineer.

20.3 DRAWINGS

20.3.1 Design and Working Drawings

These shall be prepared by the Engineer and supplied to the Contractor. These shall contain main dimensions, sizes of member & typical details of joints, list of material etc.

20.3.2 Workshop Drawings

- a) Before proceeding with the manufacture, or fabrication, Workshop drawings shall be prepared by the Contractor from the working drawings supplied, taking into consideration the following instructions:
- Fabrication in convenient sub assemblies and each shop assembly to be given an erection mark.
 - Milling (machining of bases of supporting plate) for erection without adjustments.
 - Provision of basic elements for/with erection devices.
 - Keeping with the requirements of computed strength of all connections and joints of structures not foreseen in the design and working drawings.
 - Other requirements having an influence on the technology of fabrication transportation and erection of steel structures.
 - Uniformity of elements and parts of the steel structures should be maintained for mass fabrication.
- b) Workshop drawings shall consist of two parts:
1. An erection scheme having the following information:

- o Location of erection element in respect of these elements with each other or with the existing steel or reinforced concrete structures.
 - o Erection joints showing erection welding thickness and lengths, bolts or rivet diameter and numbers.
 - o Chart showing list of assembling marks having columns such as Mark, Description, Quantity, Weight of each Mark, Total weight and Remarks with grand total in the end.
 - o Chart showing list of Erection Bolts, Nuts and Washer having columns such as size, quantity, weight and notes with grand total.
 - o The mark for shop assemblies of each erection scheme shall have a different index for example scheme of trusses purlins etc. shall have Marks A1, A2, A3, onwards and another scheme of columns beams etc. shall have Marks B1, B2, B3 and onwards. While marking on the plans, elevations, sections and details the index shall be omitted.
 - o The recommended scale of erection scheme is 1:50, 1:100, 1:200, for joints 1:5, 1:10 or 1:20.
 - o Except in special cases all scheme drawings shall be made in single fairly thick lines.
 - o Erection Scheme shall contain the following notes:
 - i) Erection shall be done using the erection welding and bolts of normal sizes and accuracy according to the joints of the scheme.
 - ii) Quality and type of electrode.
 - iii) Measures against unscrewing of bolts.
 - iv) Erection shall be carried out according to the standard for fabrication and erection of steel structures.
 - v) Painting instructions.
 - vi) References to design and working drawings.
2. A shop assembly drawing containing the following information:
- o Each Shop Assembly (Mark) shall be drawn separately showing necessary lines, elevation sections with reference to axis, centre lines, location of holes, cleats, plates lugs etc .fully dimensioned with part numbers.
 - o Bolts, holes and symbols.
 - o Geometrical Setting out dimensions necessary for the assembly of an element. Location and details of joints as calculated by the Fabricators / Engineer.

- o Instruction for welding, dimensions of weld (Seams) processing of edges, methods of welding, quality of welded material, length of welds on every element, requirements for welding and method of their control. Specification for Electrode selected according to specification of steel.
- o Standards and quality of steel used.
- o Parts List.
- o Instruction for painting, primer and finish coats with derusting process.
- o Recommended scale for assembly drawings are preferably 1:10 or 1:20 and for joints and details 1:1, 1:2 or 1:5.
- o Notes for assembly drawings shall be as follows:
 - i) List of symbols for bolts and holes used.
 - ii) List of symbols for welds used.
 - iii) Edge distance (general).
 - iv) Welding thickness (general).
 - v) Material quality of steel used.
 - vi) Type and quality of electrodes to be used.
 - vii) Test for welding if any.
 - viii) Reference to related erection scheme drawings.
 - ix) Reference to design and working drawings.

20.4 MATERIAL

Except otherwise required or stated in the drawings the materials specifications shall conform to the following. Wherever necessary Contractor may use equivalent British Standard or other alternative material subject to approval of the Engineer. Material shall generally conform to the applicable requirement of ASTM A-6.

a) Structural Steel

- Structural steel for structures not requiring Welding shall conform to the requirements of ASTM A-7-66 (for bridges and buildings) or ASTM A-36-77.
- Structural steel for structures requiring welding shall conform to the requirements of ASTM A-36-77 or approved equivalent.

b) Sheet Steel

Sheet steel for structures where no welding is required shall conform to the requirement of ASTM A-366-62T (for Cold Rolled Carbon Steel Sheets commercial quality) or ASTM A-415-64 (Standard specifications for Hot Rolled Carbon Steel Sheets, commercial quality). For structures where welding is required sheet steel shall conform to the requirements of ASTM A-415-64 and steel plate to ASTM A-283-79 (Low and intermediate strength carbon steel plate) or A-514-77 (High-yield-strength, quenched and tempered alloy steel plate, suitable for welding as required).

- c) Filler Metal for Welding
Welding Electrodes for manual shielded metal arc welding shall conform to the specifications for mild steel covered Arc-welding Electrodes, AWS A 5.5 (latest edition). Equivalent locally manufactured electrodes by Pakistan Oxygen may also be used subject to the approval of the Engineer.
- d) Ordinary Bolts, Nuts and Washers
Bolts and nuts shall conform to the requirements of ASTM A-307-65 (Standard specification for low-alloy, carbon steel, externally and internally threaded, standard fasteners). Bolts shall be of Grade A for general application with square or hexagon heads as specified in the drawings. Turned bolts shall also conform to the requirements of ASTM A-307-65, except that the tolerance of the unthreaded portion of the bolt body shall be $+0.0 - 0.15$ mm of the diameter.
- e) Cut Washers
Shall be of structural grade steel and shall conform to the dimension of the manufacturer's regular standard for plain washers for the size and type of bolts used.
- f) Cast Iron
Shall conform to the requirements of ASTM A-48-64 (Standard specifications for Grey Iron Castings) or equivalent.
- g) Iron Pipe
Where iron pipe is called for, it shall be genuine wrought iron fully galvanized. All Threads to be cleaned and coated with rust resistant coating.
- h) Painting Materials
Paintings materials which include emulsions, epoxy based enamel paints, sealers, primers, wax, varnishes etc., shall be standard best or top brands produced for each particular kind of material required.

20.5 ALLOWABLE STRESSES

- a) Allowable stresses for steel shall be considered tabulated in Appendix A of specifications for the Design, fabrication and erection of structural steel for buildings; Part 5 of the Manual of Steel Construction published by the American Institute of Steel Construction.
- b) Allowable stresses for rivets, bolts and threaded parts as per table 1.5.2.1 of AISC specifications.
- c) Allowable stresses for welds as per table 1.5.3 of AISC specifications.

20.6 FABRICATION

- a) Straightening Material
Rolled material, before being worked upon, must be straightened within tolerances by ASTM specifications A6. Straightening, necessarily shall be done by mechanical means or by the application of limited amount of localised heat. The temperature of heated areas, as measured by approved methods,

shall not exceed 1100 F for A514 steel or 1200 F for other steels. All material, before and after fabrication shall be straight or curvilinear form as required free from twists.

b) Cutting

As far as possible cutting must be done by shearing. Oxygen cutting shall be done where shear cutting is not possible and shall preferably be done by machine. All edges shall be free from gauges, notches or burs. If necessary the same shall be removed by grinding.

c) Holes punching drilling

Holes shall be punched where thickness of the material is not greater than the diameter of bolt or rivet + 3mm. Where the thickness of the material is greater, the holes shall be drilled or sub-punched and the drill of all sub drilled holes shall be at least 2mm smaller than the nominal diameter of the rivet or bolt. Holes for A514-77 steel plates over 1/2" thick shall be drilled. Holes shall not be allowed to formed gas cutting process.

d) Welding

1. Maximum Thickness of fillet welds

- i) Not more than 1.2 times the lesser thickness of materials being welded.
- ii) At welding of rolled profiles along edges, which are curved, not more than the thickness of the edge minus the radius of the curve.

2. Minimum thickness of fillet welds.

Least thickness for calculation and designing requirements:

Thickness of thicker part	Upto 10 mm	11mm to 20mm	20mm to 30mm	31mm to 50mm	Above 50mm
Thickness of Weld for carbon steel.	4	6	8	10	12
Thickness of Weld for low alloy steel	6	8	10	12	-

- 3. Design length of a fillet weld shall not be less the 40 mm or 10 times thickness of fillet weld and not more than 60 times thickness of fillet weld.
- 4. Surfaces to be welded shall be free from loose scale, slag, rust, grease, paint or any other foreign matter except mill scale which withstands vigorous wire brushing.

e) Tolerances

1. A variation of 1 mm is permissible in the overall length of members with both ends finished for contact bearing. The bearing surface is to be prepared to common plane by milling.
 2. Members without end finished for contact bearing which are to be framed to other steel parts of the structure shall have a variation from detailed length not greater than 3mm.
- f) Each piece of steel work after fabrication shall be distinctly marked before delivery to site in accordance with a marking plan for erection assembly.

20.7 SURFACE PREPARATION

- a) All steel work shall be cleaned free from loose scale, rust, dust, slag etc. by using suitable means. Sand blasting shall be carried out wherever so specified by the Engineer.
- b) Steel work to be encased in concrete or surfaces in contact with concrete or grout shall be given a cement wash.
- c) Machine finished surfaces shall be coated with rust preventive compound approved by the Engineer prior to removal from shop and immediately after finishing. Such surfaces shall be protected with wooden pad or other suitable means for transportation. Unassembled pins and bolts shall be oiled and wrapped with moisture resistant paper.
- d) All other surfaces of steel work shall be painted as specified hereunder.
 - Resin based special emulsion paint shall be manufactured by one of Pakistan paint manufacturers, as approved by the Engineer. The paint shall be composed of P.V.A. with pigment of Titanium dioxide with inert extenders, having viscosity of 70-75 K.U. at 25 deg. C and approximate specific gravity of 1.33. The paint shall have flat finish, smooth and free from brush marks and resistant to fungus growth.
 - Enamel paint and primers shall be Dulux as manufactured by M/S Imperial Chemical Industries Pakistan Ltd. or approved equal and shall be applied in accordance with the period instructions of the manufacturers.

No separate payment shall be made for painting of structural steel works. The Contractor shall include all the cost of labour, plant and material for this work in the price as mentioned in the Bill of Quantities.

20.8 ZINC COATING (GALVANIZING)

Where ever specified by the Engineer zinc coating shall be applied in a manner and or a thickness and quality conforming to the requirements of ASTM A-123-65, standard specifications for zinc (Hot galvanized) coating on products fabricated from rolled, pressed, and forged steel shapes, plates, bars and strips.

20.9 INSPECTION AND TESTS

- a) Manufacturer's Works Test certificate for all material used shall be furnished by the contractor for Engineer's scrutiny and approval. The contractor shall provide all necessary facilities to Engineer for inspection of steel structure work during fabrication and erection.
- b) Rolling tolerance of all shapes and profile according to AISC (American Institute of Steel Construction) shall be in accordance with the provisions of the American Society for Testing and Materials Designation A.6 These shall be checked by the Contractor before being worked upon and shall be rejected if found not within limits.
- c) The Contractor shall arrange for analysis and test of all material rolled locally at a testing laboratory selected by the Engineer, for which Contractor will bear all expenses.
- d) Nevertheless neither the fact that the materials have been tested nor that the manufacturers works test certificates have been furnished shall effect the liberty of the Engineer to reject after delivery, material found not according to these specifications.
- e) The inspection of welding shall be performed in accordance with the provisions of Section 6 of the code for Welding in Building Construction, DI. O-69 of the American Welding Society ("Structural Welding Code" AWS DI-1)
- f) Materials or workmanship not in reasonable conformance with the provisions of these specifications shall be rejected at any time during the progress of the work or the completion and erection at site.

20.10 ERECTION

- a) Bracing.
The frame of steel skeleton buildings shall be carried up true and plumb within the limits defined in section 7(h) of the AISC code of standard practice, and temporary bracing shall be introduced wherever necessary to take care of all loads to which the structure may be subjected including the equipment and the operation of the same. Such bracing shall be left in place as long as required for safety. Wherever piles of material, erection equipment and other loads are carried during erection, proper provision shall be made by the contractor to take care of the stresses resulting from such loads.
- b) Alignment & Bolting.
No riveting, permanent bolting or welding shall be done at site during erection until as much of the structure as will be stiffened thereby has been properly aligned. The threaded portion of each bolt shall project through the nut at least one thread.
- c) Painting after Erection.
Before painting of steel which is delivered unpainted is commenced, all surfaces to be painted shall be dry and thoroughly cleaned from all loose scale and rust. The specified protective treatment shall be completed after erection.

20.11 MEASUREMENT & PAYMENT

a) General

- i) The cost of all the works involved within the scope of this specifications as per all the drawings and conditions of contract are covered only within the quoted rate of items of the Bill of Quantities.
- ii) Unless otherwise specified and to the extent provided in the Bill of Quantities no separate or additional payment will be made for the following works, the cost of which shall be deemed to have been included in the quoted rate of the Bill of Quantities item.
 - Providing nuts, bolts, screw, rivets, heads, filets welds and welding rods.
 - Galvanizing and prime coating steel work.
 - Painting Steel Work.
 - All embedded parts other than steel.

b) Measurement

- i) Items of work of structural steel for which the unit rates have been quoted on weight basis shall be measured net as acceptably supplied and installed at site as per drawings / workshop drawings and as per instruction of the Engineer. After measurement the theoretical weights shall be calculated from standard tables of section and weights in the manner followed in the preparation of workshop drawings. The cost of loading and unloading, transportation and handling of structural steel items shall be deemed to be included in the quoted unit rate of the related Bill of Quantities item.
- ii) Measurement of acceptably completed installation and erection works of Structural steel items supplied free of cost by the Employer will be made on the basis of number of tons of structural steel items erected and installed in position as shown on the drawings or as directed by the Engineer. The cost of loading and unloading, transportation and handling of structural steel items shall be deemed to be included in the quoted unit rate of the related Bill of Quantities item.

20.12 PAYMENT

Payment will be made for acceptable measured quantity of structural steel works on the basis of unit rate quoted in the Bill of Quantities and shall constitute full compensation for all the incidental works related to the item.

ELECTRICAL WORKS

SECTION – E - 1 GENERAL SPECIFICATIONS

FOREWORD

This document is to describe the minimum requirements for the equipment and installations and to ensure that the Contractor is fully aware of his duties to perform the required works, in accordance with the terms of the Contract.

1. SCOPE OF WORK

The works related to the electrical system which are included in the scope of this Contract are shown on the Drawings, stated in the Particular Specifications, Bill of Quantities and explained in these specifications. The works shall broadly include but not limited to the following:

- | | |
|-----------------------------------|-------------------|
| 1. Conduits and Pipes | (Section – E - 2) |
| 2. Low Voltage Distribution Board | (Section – E - 3) |
| 3. Low Voltage Cables and Wires | (Section – E - 4) |
| 4. Lighting Fixtures | (Section – E - 5) |
| 5. Earthing System | (Section – E - 6) |
| 6. MV Switch Gear | (Section –E – 7) |
| 15kV Medium Voltage Cable | (Section –E – 8) |

All material and equipment supplied by the Contractor shall be new and in all respects conform to the high standards of Engineering design, workmanship, performance and function as here in specified and fully meet the quality level and rugged requirements of the specifications.

The Contractor shall also be responsible to supply any other equipment not specifically mentioned in these documents but which is necessary for proper operation of the works / system, shall be considered to have been so specified and accordingly shall be provided by the Contractor as part of the Contract.

The Contractor shall be solely responsible for ensuring proper functional requirements of various equipment and shall also be responsible for furnishing any additional piece of equipment and for making modification in the equipment as desired and / or approved by the Owner or his representative, to achieve proper coordination with various equipment offered in the bid and also those installed by others.

Approval of the Contractor's supplied equipment / installation works shall not relieve the Contractor of any of his obligations or liabilities under the Contract, except insofar as provided under the conditions of the Contract.

2. RULES AND REGULATIONS

The entire electrical installation / work shall be carried out by licensed

contractor, authorized to undertake such work under the provisions of Electricity Act 1910 and The Electricity Rules 1937 as adopted and modified up to date by the Government of Pakistan.

All works shall be carried out in accordance with the latest edition of the Regulations of the Electrical Equipment of Buildings issued by the Institute of Electrical Engineers - London, the Contract documents, the Electricity Rules 1937 and bye-laws that are in force from time to time. Any discrepancy between these specifications and any other rules and regulations shall be brought to the notice of Owner or his representative, and his decision shall be final and conclusive.

The Contractor shall be responsible for completing all formalities and submitting the test certificates as per prevailing rules and regulations and shall have the installation passed by the Government Electric Inspector of that region.

3. STANDARDS

All works, equipment and materials shall conform to:

On the one hand:

The specification recommended practices, official standards and codes the non - restrictive List of which is given below.

International Electro-technical Commission (IEC)

British Standards (BS)

National Electric Code (NEC)

National Standards

In the event of conflict between standards, the most stringent shall prevail.

Whenever the electrical equipment to be installed, does not hold national standards, the Contractor shall take into account the specific standards chosen by the Owner and make sure that the equipment he has to install, meets these standards.

In addition, even if no mention is stipulated in this specification, it is implied that the equipment be tropicalised, if required, by the conditions of the site of installation.

In any case, the standards and codes to be taken into consideration are those in force at the date of delivery.

4. INSTALLATION AND SERVICE CONDITIONS

4.1 Site Conditions

All material and equipment supplied and installed shall be designed, manufactured and tested to meet the following ambient conditions

unless specifically stated otherwise for any material / equipment:

a.	Maximum outdoor ambient temperature	:	50 degree C
b.	Minimum Indoor ambient temperature	:	0 degree C
c.	Maximum relative humidity	:	90 %
d.	Minimum relative humidity	:	40 %

4.2 Service Conditions

Equipment shall be designed and built for continuous service with a minimum of supervision and maintenance.

5. MAIN ELECTRICAL CHARACTERISTICS

5.1 Power Supply System

Unless otherwise specified elsewhere, all equipment and material shall be designed to operate and function satisfactorily with the following minimum requirements without any de-rating:

- Voltage 400 ± 10%
- System 3-Phase, 4 wire system
 1-Phase, 3 wire system
- Frequency 50 Hz. ±2 Hz.

5.2 Degree of Protection of Enclosures

For indoors, IP4X minimum degree of ingress protection of the enclosures against contact with line or moving parts and against ingress of solid foreign bodies or liquids, shall be selected, in accordance with IEC 60529. The protection class for outdoor area shall be IP-65 and for indoor damp area shall be IP-54.

6. GUARANTEE

The Contractor shall furnish written grantee which should clearly state that the works he will carry out as well as the materials he will supply, meet with this specification and that compliance thereto constitutes an official clause, added by implication to the general conditions of his offer when signing the Contract.

Guarantee shall also be for replacement and repair of part or whole of the equipment which may be found defective in material or workmanship. The grantee shall cover the duration of Maintenance Period as defined in the conditions of the Contract. This guarantee shall not relieve the Contractor of his obligations and he will fully be responsible for the repair or replacement of any defective material in time, so as not to cause any undue delay in carrying out the repairs and/ or replacements.

The Contractor shall acquaint himself fully with the existing conditions and limitations at site and all works necessary to complete the project under the Contract, to be carried out by the Contractor.

7. EXCEPTIONS TO SPECIFICATION

Any exception or deviation from this specification or the codes and standards shall be listed separately in the Contractor's "List of Deviations". Any exception, which shall not be listed, shall not be considered later.

8. AVAILABILITY OF SPECIFICATIONS, DRAWINGS AT SITE

The Contractor shall assume at his own cost the permanent availability of this specification and drawings on site where applicable.

9. DISCREPANCIES IN TENDER DOCUMENTS AND DRAWINGS

The Contractor shall carefully examine the documents and drawings and if he finds any discrepancies or omissions from the specifications, bill of quantities or drawings, or is in doubt as to the meaning, he shall at once notify the Owner or his representative for receiving his instructions before proceeding with the works. If such defective or modified work is carried out by the Contractor on his own, he shall rectify the same at his own cost.

10. MEASUREMENT OF WORKS

The quantities set out in the bill of quantities are the estimated quantities and they shall not be taken as actual and correct quantities of work to be executed by the Contractor. The Contractor shall carry out actual measurement of works at the site.

11. INSTALLATIONS DETAILS

The locations, routings, installation heights, detail etc. for electrical equipment are indicated on the drawings. If any information is not stated on the drawings or wherever modifications are required the Contractor shall obtain prior instructions from the Owner or his representative.

12. DRAWINGS AND DATA

The Contractor shall provide dimensional outline drawings, arrangement drawings and technical data for the equipment offered, for the approval of Owner or his representative.

13. PRIOR APPROVAL OF SHOP DRAWINGS, MATERIALS AND EQUIPMENT

The Contractor shall provide shop drawings for the electrical installations showing the exact routes of all underground cables and ducts, the exact run of all conduits and trunking, draw-in and junction boxes, the number and size of wires in each conduit, the final connection arrangements at distribution boards and the details of ducts for the approval of consultant / Owner's representative before commencing any portion of the works. All such shop drawings shall be submitted in suitable number of copies as indicated in the particular conditions and within the periods stipulated below:

a. Cable entry ducts into substation:

Shop drawings shall be submitted within two weeks of handing over the site.

b. All other shop drawings shall be submitted to the Engineer against

signed receipt and dated within two months of signing the Contract. Should however the Contractor be obliged to install electrical conduits prior to this period then he shall submit the relevant shop drawings at least two weeks prior to the proposed date of commencement of the work. The Contractor shall submit the program indicating the dates on which coordination in different sections will take place, together with the submission of the shop drawings. The Engineer shall arrange to return to the Contractor at least one week prior to the commencement of concreting of the section, his comments or approval of the shop drawings.

The Contractor shall supply detailed specifications, dimensional drawings, etc., of equipment that he proposes to supply and install.

Where this Contract requires the approval of Engineer to material and goods, the Contractor must seek to obtain this approval of materials and equipments within eight weeks after signing of the Contract. No extension of time will be granted for non-availability of material or goods if this clause is not complied with. Approval of the Engineer does not relieve the Contractor of placing his orders in due time for the materials he needs to complete the Contract on time. The approved samples shall be retained on site for comparison with commodities used in works and removed when no longer required.

14. MATERIAL ORIGIN AND QUALITY

The material and equipment shall be purchased from Consultant / Owner's agreed suppliers.

The consultant / owner shall retain the right to at any time demand the indication of origin of the materials, and to eventually refuse products, the origin of manufacturing of which have not been previously agreed to without consideration of quality.

On specific agreement of the Owner, the materials may be delivered progressively to the field, but in such a manner as to allow sufficient time for their reception.

When choice of manufacturer is allowed for any particular commodity the Contractor shall obtain the whole quality required to complete the work from one manufacturer or obtain approval of any change in source of supply. He shall produce written evidence of sources of supply when requested to do so by the Engineer.

15. IDENTIFICATION OF EQUIPMENT

For each piece of equipment, identification label of stainless steel shall be fitted in front of the casing. The label shall have block letter 7mm high, black on white back ground of stainless steel sheet and fixed with screws.

16. MARKINGS

The contractor shall provide "Danger Boards "and" Shock Charts "wherever

required to comply with the requirements of local Electricity Rules and according to normal practice.

17. FACTORY TESTS

All equipment/materials supplied by and installed as part of the Contract such as distribution boards, cables, uPVC pipes and like; shall be fully tested at the manufacturer's works to the requirements of appropriate standards called for later in the particular specification.

The Contractor shall inform the Engineer in writing about the date and time of test of each equipment with test protocol at least two weeks in advance. The witnessing of test by the Owner or his representative shall not absolve the Contractor from his responsibility for the proper functioning of the equipment and for furnishing the guarantees referred to in Clause 6.0. All test results in the form of certificate of test / test record certificates, signed by all the witnesses, for each item in the scope of Contractor's supply shall be supplied to the Engineer within seven days of the test date, and in any event before delivery to the site.

All expenses for carrying out the tests and witness by the Owner or his representative shall be borne by the Contractor and deemed to have been included in the tender bid.

18. STORAGE

The Contractor shall store the equipment in such conditions that it cannot be damaged, i.e., in a dry warehouse. As particular concerns; fragile components, these shall be stored on shelves in their original packing, fitted with identification labels so as to avoid unnecessary manipulation or handling.

The Contractor shall handle, store and fix each commodity in accordance with the manufacturer's recommendations. He shall inform the Engineer if these conflicts with any other specified requirement and submit copies of manufacturer's recommendations to the Engineer when requested to do so.

19. LABOUR AND STAFF OF CONTRACTOR

The Contractor shall provide / furnish and arrange for:

- Skilled and unskilled labor required for performing the works in accordance with the technical specifications and drawings within the agreed time schedule.
- Supervisory technical staff with appropriate experience and requisite expertise to ensure quality of work performed.
- Supervisory administration and clerical staff to ensure smooth functioning of the activities at site.
- Construction equipment, meggers, tools, etc.

The Contractor shall supply all labor, materials and equipment necessary for the installation of low voltage distribution boards, cables, lighting and power equipment, together with all other apparatus shown on the drawings and as detailed in the Particular specification.

20. SMALL INSTALLATION MATERIAL

The Contractor shall supply all small installation and consumable materials such as nuts, bolts, washers, shims, angles, leveling materials, insulation tape, solder, PVC strap-on or heat shrinkable type cable tags, cable ties, bushes, sealing compound, Avometer, electrical testing and measuring instruments, etc., and all such other material not listed in BOQ, required for complete installation as intended by the specification and scope of works.

21. INSTALLATION INSTRUCTIONS - GENERAL

The Contractor shall set out the works himself as per specifications and drawings and shall properly position the equipment on specified foundation / location. In general, the manufacturer's instructions for installation shall be followed. Any defect or faulty operation of equipment due to Contractor not following the manufacturer's instructions shall be corrected and repaired by the Contractor at his own cost.

22. ASSOCIATED CIVIL WORKS

The expression 'Associated Civil Works' shall mean civil work to be carried out by the Contractor under the direction of the Engineer in connection with the Electrical Service.

The Contractor shall prepare accurate drawings giving details of all holes, fixings, bases and other civil work requirements and shall be responsible for their accuracy. The cost of preparing shop drawings shall be considered to have been so specified in the tender price.

The following is a summary of the work to be carried out by the Contractor:

- a. The cutting and forming of holes for conduits or pipes, or conduit or pipe fixings through walls, floors, ceilings, partitions, roofs, etc., and making good after the work is sufficiently advanced.
- b. The building of concrete and / or brick ducts in floors, walls, etc.
- c. The formation of concrete bases, etc., for equipment
- d. Excavation forming for underground services of ducts and courses and then covers it.
- e. The cutting or forming of chases, recesses, etc., in floors, walls, etc., for conduits and fittings in and making good.
- f. Excavation for and laying of cable carrying pipes.
- g. The building in of brackets and supporting bars or other form of conduit or pipe suspensions.
- h. The painting of all pipes, tube and conduits etc. after fixing unless specified to the contrary.
- i. The providing and building in of sleeves through slabs and walls.

In general all required holes through walls, floors and beams for pipes and ducts will be left out by the Contractor during the process of building.

Where conduits, pipes or fittings are fixed to concrete or woodwork by means of saddles or clips, the Contractor shall himself execute the work necessary and the cost of such work shall be considered to have been so specified in the price.

Cutting, fitting, repairing, patching or plastering and finishing of carpentry work shall be done by craftsmen skilled in their respective trades, when cutting is required it shall be done in such a manner as not to weaken structure, partitions or floors. The holes required to be cut must be directed without breaking out around the holes. Where patching is necessary in finished areas of building, the Engineer shall determine the extent of such patching or refinishing.

23. TESTING - GENERAL

Upon completion of installation, at least seven days notice is to be given of intention to perform any test. The Contractor shall perform all static, semi-dynamic (by simulation), and dynamic field testing on all the equipment and systems.

All tests shall be conducted in the presence of the Engineer for the purpose of demonstrating equipment or system compliance with specifications. The Contractor shall submit for Engineer's approval complete details of tests to be performed describing the test procedure, test observations and expected results.

The Contractor shall furnish all tools, instruments, test equipment, materials, etc., and all qualified personnel required for the testing, setting and adjustment of all electrical equipment and material including putting the same into operation.

All tests shall be made with proper regard for the protection of the personnel and equipment and the Contractor shall be responsible for adequate protection of all personnel and equipment during such tests. The cost of any damages or rectification work due to any accident during the tests shall be the sole responsibility of Contractor.

The Contractor shall record all test values of the tests made by him on all equipment. Four copies of all test data and results certified by the Engineer shall be given to the Engineer for record purposes. These shall also include details of testing method, testing equipment, diagrams, etc.

The witnessing of any tests by the Engineer does not relieve the Contractor of his guarantees for materials, equipment and workmanship, or as any obligations of Contract.

In addition to installation testing, the Contractor is to carry out operation testing of all sections and is to clean, set, calibrate and fully commission, demonstrate and hand over to the Owner the entire Contract works in a thoroughly complete and operational state to the satisfaction of the Engineer.

The acceptance - provisional or final- shall be made by the Owner. This reserves him the right to be represented or assisted by a representative or an organization (whether official or not) of his choice, which may decide on his behalf any repairs deemed necessary resulting from lack of observations of this specification, or of the rules and standards. In addition, he may judge the quality of the works and the materials supplied.

This remains in force in case of sub-contracting.

The Contractor shall formally engage his direct responsibilities to the Owner or his representative, and likewise, shall assume all responsibility for work performed by sub-contractors and materials he has supplied and installed.

23.1 Insulation Resistance Test

Insulation resistance test shall be made on electrical equipment by using a megger of 1000 volts for circuits between 250 and 500 volts. The insulation resistance of distribution boards, cables, etc., shall be as per IEC, IEEE, BSS and Pakistan Electricity Rules.

The distribution boards shall be given an insulation resistance measurement test after installation, but before any wiring is connected. Insulation tests shall be made between open contacts of circuit breakers, switches and between each phase and earth.

If the insulation resistance of the circuit under test is less than specified value, the cause of the low reading shall be determined and removed. Corrective measures shall include dry-out procedure by means of heaters, if equipment is found to contain moisture. Where corrective measures are carried out, the insulation resistance readings shall be taken after the correction has been made and repeated twice at 12 hours interval. The maximum range for each reading in the three successive tests shall not exceed 20% of the average value. After all tests have been made, the equipment shall be reconnected as required.

23.2 Earth Resistance Test

Earth resistance tests shall be made by contractor on the earthing system, separating and reconnecting each earth connection as may be required by the Engineer. If it is indicated that soil treatment or other corrective measures are required to lower the ground resistance values, the Engineer will determine the extent of such corrective measures.

The electrical resistance of the E.C.C. together with the resistance of the earthing lead measured from the connection with earth electrode to any other position in the completed installation shall not exceed one ohm.

Earth resistance test shall be performed as per Electrical Inspector's

requirements. Where more than one earthing sets are installed, the earth resistance test between two sets shall be measured by means of Resistance Bridge Instrument. The earth resistance between two sets shall not exceed one ohm.

23.3 Switchgear

Each circuit breaker shall be operated electrically and mechanically. All interlocks and control circuits shall be checked for proper connections in accordance with the wiring diagrams given by the manufacturer.

The Contractor shall properly identify the phases of all switchgear and cables for connections to give proper phase sequence.

Trip circuits shall be checked for correct operation and rating of equipment served. The correct size and function of fuses disconnect switches, number of interlocks, indicating lights and alarms shall be in accordance with approved manufacturer drawings. Nameplates shall be checked for proper designation of equipment served. Protective relays shall be tested and set at site prior to commissioning of the equipment.

23.4 Special Systems Tests

The special systems such as telephone, intercom, etc., shall be tested according to the procedures laid down in the respective sections of the technical specifications. However, any specific tests recommended by the manufacturer shall also be carried out as approved by the Engineer.

23.5 Complete Tests

After any equipment has been tested, checked for operation, etc., and is accepted by the Engineer, the Contractor shall be responsible for the proper protection of that equipment so that subsequent testing of other equipment do not cause any damage to the already tested equipment.

24. ELECTRICAL CONNECTION

Electrical connection for substation necessary arrangement and coordination to be done by the Contractor.

25. AS BUILT DRAWINGS AND SERVICE MANUALS

A record shall be kept as the work proceeds of any work not in accordance with the shop/construction drawings, and upon completion of the work, the Contractor shall prepare the following drawings and forward them to the Engineer for approval:

- a. Duplicate prints of as built single line diagram of the main and sub main distribution network, indicating all cables, their size and type, and the rating of all protection devices such as circuit breakers, fuses, etc.

- b. Duplicate prints of as built drawings of Lighting, Power, and Telephone as applicable.
- c. Duplicate prints of as fixed control and wiring diagrams for the equipment installed as part of the Electrical Contractor works.

After these drawings have been approved, the Contractor shall supply two prints on paper of each and insert these in the operating and maintenance manual specified below.

The Contractor shall submit to Engineer for approval a sample of manufacturer instructions for installation, testing, commissioning, operation and maintenance manuals including manuals of spare parts and tools of the equipment. Upon acceptance, the Contractor shall supply three copies to the Engineer for forwarding to the Owner. These manuals should be in properly bound form. At least two copies of the documents shall be submitted in original. The installation instruction shall be submitted two weeks prior to commencement of installation of each equipment, and operation and maintenance instruction at the time of commissioning. If the Contractor fails to provide the documents, the Engineer shall withhold issuance of requisite certificates and deduct suitable amount from the payments to the Contractor.

26. WORK COMPLETION

The Contractor shall further make good, repair, replace all defective works and clear away on completion and leave all installations in perfect working order and to the satisfaction of the Owner or his representative.

27. PAYMENT

No separate payment shall be made for work involved within the scope of this section unless specifically stated in the Bill of Quantities or herein.

SECTION - E - 2 CONDUITS AND PIPES

1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete Conduits and Pipes as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of conduits and pipes.

The Conduit and Pipes with accessories shall also comply with the General Specifications for Electrical Works, Section E- 1 and with other relevant provisions of the Tender document.

2. GENERAL

The extent of works shown on the drawing does not indicate the exact position of conduit and pipes. The Contractor shall ensure exact location and route of conduit and pipes in coordination with other services drawings, as per site requirements and as directed by the Engineer.

The quality and material for the accessories of conduits and pipes such as sockets, elbows, bushings, bends, inspection / pull boxes, round boxes, etc., necessary for the completion shall be similar to that of conduit or pipes. All the accessories shall be supplied by the Contractor without any extra cost and deemed to have been included in the price of conduits / pipes.

3. STANDARDS

Pipes and Conduits shall comply with Section - E-1, Clause 3.

Particular reference shall be made to:

BS 31	Steel Conduit and accessories
BS 1378	Galvanized Iron Pipes and accessories.
BS 3595	PVC Pipes and accessories.
BS 4607	PVC Conduits and accessories.

Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 PVC Conduits, Pipes and Accessories

The PVC conduits and accessories for lighting and power circuits shall be furnished by the Contractor as shown in the drawings or given in BOQ. The PVC bends shall have enlarged ends to receive conduit without any reduction in the internal diameter at joint. Manufactured smooth bends shall be used where conduit changes direction. Bending of conduits by heating or otherwise will be allowed in special situations only, for which the consent of the Engineer shall be required. The use of sharp 90 degree bends and tees will not be allowed for

concealed wiring.

The round PVC junction boxes for ceiling light or fan points shall have minimum dimensions of 64 mm diameter and 64 mm depth. The junction boxes for wall light points shall have minimum dimensions of 57 mm diameter and 40 mm depth. Round junction boxes shall be provided with one piece bakelite cover plate fixed to the box by means of galvanized screws.

The PVC pipe shall be rigid and shall be minimum D-Class (working pressure - 12 Kg / cm), unless otherwise stated on Drawings or Bill of Quantities. Where pipe changes direction, manufactured smooth bends shall be used. For jointing of pipe, all precautions and procedures recommended by manufacturer shall be followed.

4.2 Steel Conduit and Accessories

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

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

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

4.3 Galvanized Iron Pipes and Accessories

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

4.4 Inspection Boxes / Pull Boxes

The rectangular inspection boxes or pull boxes shall be of 16 SWG heavy gauge, sheet steel having nipples welded to box at entry holes to receive PVC conduit with force fit. The box shall be painted inside

and outside with black enamel paint over a base coat of red oxide primer paint. The minimum length of inspection box shall not be less than six times the cable manufacturer's recommended bending radius of the cable. All concealed type pull boxes shall have a white plastic sheet of appropriate size fixed to the box by means of galvanized screws.

4.5 Underground UPVC pipe

When cables cross road, paved area, other services or other cables, they shall be laid in protective pipes of required size. Underground UPVC pipes should be according to standard BS-50086. It must possess high anti current puncture strengths, and can resist upto 25kV, resist compression and impact, must have good combustion resistance, self extinguishing, moisture proof and resist biotic attack. Cables entering the substation shall also be laid in protective pipes. The protective pipes ends, after installation of cables, shall be plugged water tight by means of bituminized herisan or equivalent method as approved by the Engineer.

The Contractor shall plan and take special care to prevent any damage to existing underground facilities such as underground piping, cables, foundations, etc. The Contractor shall notify the Engineer of any obstruction encountered and shall provide protective support or removal of such obstructions as instructed by the Engineer.

4.5 Conduit / Pipe Accessories

Bushes, plugs, glands, etc., shall be of brass and all male bushes shall be of long thread pattern. Covers for boxes shall be screw fixed and finished as the boxes. Gaskets shall be fitted only when finish is galvanized unless otherwise specified.

4.6 Cable Trunking

Where required, wiring shall be run in hot-dipped galvanized (after fabrication) sheet steel cable trunking of the specified gauge complete with all fittings and accessories, manufactured and installed in accordance with BS 4678/NEMA. The trunking shall be constructed with return flanges. Trunking covers shall be secured by anchored turn-buttons and locking bars and minimum length of individual sections shall be 2.44-m. The trunking shall be suspended/supported from the structure at maximum 2-m intervals with straps and hangers fabricated from minimum 6-mm dia HDGF bars, or supported by angle-iron brackets.

Conduit drips from the trunking shall also be supported with hangers. Factory made connectors shall be used at joints.

Junctions (tee and 4-way) in multi-compartment trunking shall be double depth to avoid reduction in cabling space. Cable in vertical runs shall be supported by pin racks, prongs or bridging pieces. Fire barriers shall be provided at each floor level. Allowance for expansion

shall be incorporated.

Bonding links shall be provided at each joint and secured by screws, nuts and shockproof washers. The bonding links shall make contact with the metal of the trunking or fitting, and continuity shall not depend on contact through the screws or on removal on site paint finish from ferrous metal.

5. INSTALLATION

5.1 PVC Conduits - Concealed

The conduit shall be installed concealed in roof, wall, column, etc. At all joints and bends, PVC jointing solution as manufactured by Pakistan PVC Limited or approved equivalent must be used to strengthen and to seal the joint.

Manufactured smooth bends shall be used. Bending of conduits by heating or otherwise will be allowed in special situations only, for which the consent of the Engineer shall be required. The use of 90 degree bends and tees will not be allowed.

The conduit shall have a minimum of 38 mm cover of concrete. In the reinforced cement concrete (RCC) work, the conduit shall be laid before pouring of concrete. Under no circumstances shall chases be made in the RCC structure for concealing conduit and accessories, after pouring of concrete. The concrete shall be supported on top of bottom reinforcement of slab and shall be firmly secured by tying to the reinforcing steel in order to avoid being disturbed during pouring of concrete.

All outlet boxes to be firmly supported and installed such that they finish flush with the soffit of slab of beam.

Where conduits have to be concealed in cement concrete (CC) work after concreting, or in block masonry, chases shall be made with appropriate tools and shall not be made deeper than required. The conduit shall then be fixed firmly in the recess and covered with cement concrete mixture to have to at least 32 mm covered before plastering. The work of curing in the cement concrete work or block masonry work shall be coordinated with the civil work. The Contractor shall obtain approval from Engineer for the route, to suit the site conditions before starting chasing and cutting.

The termination of conduits at or near the Switchboard / Distribution Board is shown diagrammatically on the drawing. The exact final locations of the termination shall be coordinated with the Switchboard / Distribution Board to be installed. Any extension of conduit near the Switchboard / Distribution Board to suit the site condition shall be made without any extra cost. Conduit ends pointing upwards or

downwards shall be properly plugged in order to prevent the entry of foreign materials. All openings through which concrete may leak shall be carefully plugged and boxes shall be suitably protected against filling with concrete. At all termination of concrete, soft bushes shall be fixed to prevent sharp edges of conduit ends from cutting or damaging the wires or cables to be pulled through them.

The entire conduit system shall be installed and tested before wiring is carried out. Any obstruction found shall be cleared by use of cutting mandrel or other approved device and the conduit shall be cleaned out before the installation of cable.

Pull boxes / Adaptable boxes shall be provided in conduit runs wherever required to facilitate pulling operation. The drawings are diagrammatic and do not indicate the position and spacing of pull boxes or adaptable boxes. However, these shall meet the following requirements:

- Pull boxes.
For straight runs the spacing shall not be more than 30 meters.
For runs with one 90 degree bend, the spacing shall not be more than 15 meters.

Wherever the conduit lengths cross the expansion joint either along the column or slab, suitable arrangement shall be provided so that when the conduit lengths in the expansion joint are stressed, the conduit neither develops any cracks nor breaks down.

Bending, off setting and similar operations shall be performed through the help of proper bending tool to give a perfect bend of required angle without Desha ping of conduit to the least.

5.2 Steel and G.I Conduit

The minimum size of conduit shall be 20 mm. The use of solid or inspection elbows, bends or tees will not be permitted and 120 degree bends shall be limited to one between any two drawn-in boxes.

Conduit coupling joint shall not be used where conduit enter spout entry boxes. Conduit running, joints shall not be used where conduit enter conduit boxes or spout entry boxes.

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

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

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

the flanged socket and the equipment or box.

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

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

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

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

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

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

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

5.3 Fixing of Conduits and Fittings

Conduits in buildings shall be fixed with galvanized distance saddles. Where a number of conduits follow a single route they may be fixed to mild steel brackets.

Conduits shall be supported on both vertical and horizontal runs as follows:

- Conduits size 20 mm and 25 mm maximum spacing of fixing 1000 mm.
- Conduit sizes larger than 25 mm spacing of fixing 1500 mm.

All conduit boxes that support fittings shall be securely fixed. All conduits shall be fixed 150 mm before and after every right angle or off set. All conduit fittings and equipment shall be fixed true and line able.

All conduit bends shall be made with an approved conduit bending machine or hickory. The radius of curvature of the inner edge of any bend shall not be less than the following table:

Conduit size	Radius
20 mm (3/4")	Not less than 130 mm.
25 mm (1")	Not less than 150 mm.
32 mm (1-1/4")	Not less than 200 mm.
38 mm (1-1/2")	Not less than 255 mm.
50 mm (2")	Not less than 305 mm.
70 mm (2-1/2")	Not less than 380 mm.
82 mm (3")	Not less than 460 mm.
100 mm (4")	Not less than 610 mm.

Underground conduit stud-up or kick pipe through concrete envelope shall be extended a minimum of 150 mm above grade and adequately braced to prevent shifting during concrete pouring work. The concrete envelope shall extend at least 76 mm above grade. Under floor conduit installation shall be at a minimum depth of 120 mm from finished floor level. The G.I. pipes / conduits shall be installed at a minimum depth of 1000 mm measured from the top of size to the finished road level.

5.4 Location of Conduits and Fittings

Before conduits are installed, confirmation shall be obtained that the conduit may be installed in that position.

Particular attention shall be given to the location of conduits to prevent the infringement of headroom and access ways.

Conduits shall be located to avoid obstructions, furnaces, hot lines and other places of high temperature.

Conduit shall not be less than 150 mm (6") where it runs parallel to or crosses hot surfaces. Underground conduit runs shall be kept to minimum in both number and length. Conduits shall not be recessed in fair brick work.

Draw boxes shall be so positioned to enable the cables to be drawn in easily. The boxes shall not be located in the comers or other such locations and shall be positioned to avoid tight bends, bending and cable kinks.

Conduits shall not generally be installed having a greater length 12,000 mm (40 feet) between draw-in boxes.

Conduit entries shall wherever possible be located in the bottom of boxes and equipment etc.

SECTION - E – 3 LOW VOLTAGE DISTRIBUTION BOARD

1.0 GENERAL

1.1 Purpose

This section together with its appending document covers the minimum requirement for the design, construction and performance of factory built assemblies of LV switchboard/distribution board.

1.2 Scope of Work

The work under this scope consists of supplying, installation, testing, connecting and commissioning of all material and services of the complete distribution board as specified herein and/ or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of LV switchboard/distribution board.

1.3 Standards

Switchboard shall comply with Section - E - 1, Clause 3.
Particular reference shall be made to:

IEC 60027	Letter symbols to be used in Electrical technology.
IEC 60051	Direct setting electrical measuring instruments.
IEC 60073	Colour for indicator lights and push bottoms
IEC 60158	LV Switch gear and control gear.
IEC 60185	Current Transformers.
IEC 60186	Voltage Transformers.
IEC 60269	LV fuses.
IEC 60439	Factory built assemblies of LV switch gear and control gear.
IEC 60529	Degree of protection provided by enclosures.
IEC 60617	Graphic symbols for diagrams.
IEC 60947-2	LV Switch gear and Control gear.
BS 951	Earthing Clamps
BS 1433	Hard drawn bare copper conductor for earthing.
BS 2874	Nuts, Bolts, Washers and Rivets for use on copper.
BS 6346	PVC Insulated Cables.
CP 1013	Earthing

Any other standard referred to in above standards or these specifications.

1.4 Installation and Service Conditions

For general site conditions refer to Section - E- 1, Clause 4.

Switchboard shall be installed indoor. The equipment shall be capable of operation under the prevailing ambient conditions without any

deleterious effect of any kind. Switchboard shall be suitable for continuous operation at full load rating under combined variation of both voltage and frequency as stated in Section - E-1, Clause 5. Transient voltage depression down to 80% of rated voltage shall not affect the performance of the equipment and dip voltage must be within permissible limit.

2.0 MAIN ELECTRICAL CHARACTERISTICS

2.1 Power Supply System

Main characteristics of power supply system applicable to all switchboards are:

- Voltage 400 V \pm 10%
- Phase 3 ϕ , 4 Wire.
- Frequency 50 Hz. \pm 2 Hz.
- Neutral system Solidly grounded.
- Peak asymmetrical SCC To be specified by the bidders.
- RMS symmetrical SCC To be specified by the bidders.

2.2 Ratings

The equipment shall be capable of carrying the specified current on a continuous basis of 24 hours / day, without exceeding the permitted temperature.

The current ratings of all equipment must be guaranteed at the specified design temperature. Equipment shall be fully rated and constructed for withstanding, making and breaking the specified short circuit duty.

3.0 GENERAL REQUIREMENTS

3.1 Concept

The Switchboard shall be of standard, prefabricated metal clad cubicle(s), floor mounting type, totally enclosed, dead front, dust tight and vermin proof requiring front access only. It shall complete in all respects with material and accessories, factory assembled, tested and finished all according to the specifications and to normal requirements. For indoor installations the international classification shall be IP42, for indoor damp area IP-54 and for outdoor area IP-65.

The Switchboard with all components and accessories shall be suitable for front operation only and shall:

- have a rated service short service breaking capacity, Ics at 400 VAC, conforming to IEC 60947-2 unless otherwise stated on the drawings.
- be provided with adequate clearance from live parts so that flash over cannot be caused by switching, vermin, pests, etc.
- have all components rated for insulation class 600-volt minimum.

- be designed for flush mounting of all instruments on the front side.
- have all incoming or outgoing connections from the top or bottom as required.
- have the components mounted so as to facilitate ease of maintenance from the front.
- have common lamp test facility for all lamps.
- have pocket for wiring diagram on the inside of door of the switchboard.
- be labeled with nameplate on the front side of door.
- have arrangements for extension of switchboard in future.
- have flexible copper braid for door earthing.

3.2 Accessibility

Switchboard shall preferably be arranged for bottom cable entries. Adequate space must be provided for cable entries and termination. It shall be possible to work easily and safely on cable of a main or control outgoing circuit in OFF position with the remainder of the board alive.

Adequate system shall be provided for installation and clamping of cables inside the cable compartment. Position of terminals and cables shall allow use of clamp ammeter.

Power and Control cable termination shall avoid obstruction to other cable termination and provide easy access for terminating cables. Cable supports shall be provided to avoid undue strain on cable termination. Easily accessible locations shall be reserved in the compartment for measuring transformers.

3.3 Name plates

On the front side, a stainless steel name plate shall be provided at the top to indicate the name of manufacturer, system voltage and frequency and the current carrying capacity of switchboard.

Each breaker shall have a circuit identification label fitted below the breaker aperture or as suitable.

Drawing indicating the branch circuit names, breaker elements, cable sizes and connecting services shall be placed in a clear plastic pocket provided at the back of the front access.

Labels described shall have block letters 7 mm high on a white background, to be made from stainless steel sheet and be fixed with screws.

Each incoming and outgoing circuit shall also be labeled with name plate 75 mm x 15 mm, as described above on the front side of door.

4.0 DISTRIBUTION BOARDS

The enclosure of the LV Distribution Board shall be fabricated from electro-galvanized / zinc coated sheet steel. IP rating for indoor area shall be IP-42, indoor damp area shall be IP-54 and outdoor area shall be IP-65.

The LV Distribution Board shall be fabricated with 16 SWG sheet steel recess or surface mounting. All components shall be installed on a common component mounting plate made of 14 SWG sheet steel inside the enclosure and protected from the front with screwed sheet steel front plate. The door and dead front covers shall be made of 14 SWG sheet steel. The door shall be fully gasket with hinges on the left hand side and locking handle on the right hand side for fastening the door. The locking handle should be detachable. The dead / front assembly shall be fastened to the enclosure by means of self - locating fasteners for quick and easy fixing.

The distribution board shall be supplied complete with all installation materials as recommended by the manufacturer. The incoming and outgoing cable connections shall be according to the wiring requirements. If required, an adapter box for accommodating the cables and conduits may be provided. The box shall be of the same material and finish as the Distribution Boards.

An earth bar or terminal strips shall be provided for connection of incoming and outgoing earth conductors. The earth bar or terminals shall be permanently connected to the body of Distribution Boards at two points. Flexible copper strip shall be provided for earthing of the door of Distribution Board.

Neutral bus assembly shall consist of outgoing screw terminals with one terminal for each MCB. All holes, cutouts, etc., shall be tool or jib manufactured and free from burrs and rough edges. Removable gland plates shall be provided at both the top and / or bottom, as required. Colour of the sleeves for phase, neutral and earth identification shall be provided.

The cabling inside the distribution board shall be suitably numbered and harnessed by means of straps or cords. Wiring to door mounted components shall be in flexible PVC conduit. All indicating, control and selecting equipment shall be suitably arranged and clearly labeled with indelible labels indicating the rating of fuses, switches, etc.

All metal work of the distribution board shall be cleaned down to bare shining metal, phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of colour RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

5.0 COMPONENTS

The switchboards shall be provided with all components as specified or

shown on the Drawings and as necessary for the satisfactory operation of the Switchboard and of the electrical system. All components should comply with IEC 60947-2. Typical specifications are given hereunder:

5.1 Moulded Case Circuit Breaker

These shall be three pole 400 / 500 volts rating shown on the drawings. The breakers shall have both time delay over current and instantaneous short circuit protection.

The MCCBs shall be installed such that their switching levers are accessible through the dead front plate for operation. Circuit numbers / designation on all circuits shall be conspicuously marked to facilitate connection and maintenance.

The breaker shall have quick make - quick break toggle mechanism with positive 'ON', 'OFF' and intermediate 'Tripped' positions.

Trip mechanism shall be trip free on overload or short circuit ensuring that the breaker will not close / remain close even if the close command is given while the circuit breaker has tripped due to short circuit or continuing overload.

5.2 Miniature Circuit Breaker (MCB)

The MCBs with current rating from 3 to 80 amperes shall be conforming to BS EN 60-898 or IEC 60947-2. The circuit breakers shall be suitable for DIN-rail mounting, maintenance-free and fully tropicalised.

The MCBs shall be designed for horizontal or vertical mounting, or reverse feeding, without any adverse effect on electrical performance.

The operating mechanism shall be quick make, quick break type, trip free, with all poles opening and closing simultaneously (except for the neutral pole, which if required shall be of the advance-closing and late-opening type). The operating toggle shall clearly indicate the ON and OFF/TRIP positions.

The individual operating mechanism of each pole of a multiple MCB shall be directly linked within the MCB casing and not by the operating handle.

Each pole of the MCBs shall be provided with bimetallic thermal element for overload protection and a magnetic element for short circuit protection.

6.0 PARTICULAR COMPONENT REQUIREMENTS

6.1 Current Transformers

Current transformers shall comply with the requirements of IEC 60185 (or equivalent).

Current Transformers shall be polyester resin insulated, ring type, air cooled having transformation ratio as indicated on the drawings. The current Transformers shall be of suitable burden having accuracy class 1.0. The Current Transformers shall have rated secondary current 5A or as required.

Current Transformers shall mechanically and thermally withstand the specified short circuit capacity. Test terminal blocks shall be provided for current Transformer secondary circuits having short circuiting provisions to allow portable apparatus to be connected.

6.2 Ammeters and Voltmeters

Indicating instruments shall be semi-flush Switchboard type, moving iron, spring controlled with standard scale having white background and black graduations and markings.

Indicating instruments shall be 1.0 class percent of full scale basic accuracy class in accordance with IEC 60051.

The ammeter shall be suitable for connection to 5 Amp. Secondary of Current Transformer or directly through shunt as shown on the drawings. The instruments shall have measuring range indicated on the drawings. A red mark shall be provided at the working voltage on the scale of all voltmeters.

6.3 Selector Switches

Ammeter and voltmeter selector switches shall be complete with front plate, grip handle, R-Y-B and OFF position for ammeter and RY-YB-BR-RN-YN-BN and OFF positions for voltmeters.

The selector switches for controls shall be rotary cam type and shall be provided complete with knob and front plate, showing all positions as required.

6.4 Push Buttons

The push buttons shall be momentary make / break contact type (normally open / normally close) and suitable for flush mounting. The push button for ON and OFF switching shall be red and green respectively.

6.5 HRC Fuses

HRC Fuses shall be provided complete with fuse bases, fuse, etc. The fuses shall have a fusing factor as specified for class QI in accordance with BS 88.

6.6 Pilot Lamps

Switchboard shall be provided with phase indicating pilot lamps. The lamps shall be rated for 250 volts supply and suitable for flush mounting. The front of the lamps shall have colored rosettes for identification of phases.

6.7 Secondary Wiring

All wiring shall be copper conductor, thermoplastic insulated, at least 1 sq. mm flexible, neatly arranged and clipped in groups.

Each conductor and its termination are to be identified and marked with numbered ferrules. All live terminals are to be shrouded.

Secondary wiring for Current Transformers shall be carried out with not less than 2.5 sq. mm. Terminals shall be specially marked to avoid opening of the circuit by accident.

7.0 INSTALLATION

The LV Switchboard shall be installed at location shown on the drawing. The Contractor shall ensure coordination with civil works for providing any openings, holes, etc. to avoid any breakage to completed works. In case the provisions in civil works for the installation of electrical equipment are not made or made incorrect the same shall be rectified by the Contractor at his own cost and to the satisfaction of the Engineer. The Contractor shall provide foundation bolts and grout them in cement concrete floor using non-shrinkable material with the approval of Engineer.

All installation material for physically erecting the Switchboard, such as bolts, nuts, washers, supporting steel, etc., shall be provided and installed by the Contractor. The Switchboard shall be installed upright and in level and shall be firmly and rigidly bolted to the floor and concrete supports.

The switchboard shall be completely erected as per manufacturer's instructions and as approved by the Engineer. Loose parts dispatched by the manufacturer shall be installed and connected as per assembly drawing provided by the manufacturer. Any safety locking provided by the manufacturer for safe transportation shall be released only after the switchboard is erected in position.

The incoming and outgoing cables shall be connected as recommended by cable manufacturer. The cable armour shall be connected effectively to ground.

The Switchboard body shall be connected to earth as per instructions given in section "Earthing" of these specifications. The Switchboard shall be tested and commissioned in the presence of the Engineer. The tests to be carried out shall be tested before energizing as per instructions contained in the article "Testing" of General Specifications of Electrical Works, section E-1 of these specifications.

SECTION - E – 4 LOW VOLTAGE CABLES AND WIRES

1. SCOPE OF WORK

The work under this scope consists of supplying, installation, testing, connecting and commissioning of all material and services of low voltage cables and wires and the accessories as specified herein or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

The LV cables and wires with accessories shall also comply with the General Specifications for Electrical Works, Section E- 1 and with other relevant provisions of the Tender document.

2. GENERAL

All multicore and single core wires for light circuits, socket outlets and circuits operating upto 250 volts shall be 450 / 750 volts grade. All single core sheathed cables shall be of 450 / 750 volt grade and up to 16 Sq.mm and above shall be of 600/1000V. Power cables for main feeders, main to sub main feeders, power equipment, etc., armoured or unarmoured shall be of 600 / 1000 volts grade. Armouring of cables shall be done with appropriate size galvanized steel wire as per codes.

The conductors shall be stranded, high conductivity, soft annealed copper. Conductor of single core cables shall be circular, whereas of multicore cables may be circular or shaped according to standard practices and codes. The PVC insulation shall be extruded with a PVC compound having good flexibility, resistance to aging and ability to withstand the ambient temperatures as given in General Specifications for Electrical Works, Section E-1 of these specifications. Cable should be capable of running 125% of full load current without any damage.

Embossed marking on the over sheath at suitable intervals shall give the following information:

- Name of manufacturer
- Year of manufacture
- Size of cable in sq.mm
- Voltage grade
- Type of cable i.e. Cu/PVC/SWA/PVC

3. STANDARDS

LV Cables and Wires shall comply with Section – E -1, Clause 3.

Particular reference shall be made to:

BS 6004 / 6346	PVC insulated cables for lighting and power.
BS 6746	PVC insulation for electrical cables.
BS 6360	Copper conductors
BS 6500	Insulated flexible cords.

Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 General

The power, lighting and control cables shall be furnished and installed in accordance with the routes and requirements shown on the drawings.

All cables shall have phase identification colours on insulation of each core. The colour code for three phase circuits shall be red, yellow and blue for phase conductors and black for neutral conductor. Where insulated earth conductor is installed, it shall have green colour insulation.

Single phase circuits shall have insulation of red colour for phase / line, black colour for neutral and green colour for earth conductor.

All DC circuits shall have insulation of red colour for positive, black colour for negative and green for earth conductor.

The ends of each length of multicore armoured or unarmoured cables shall be properly marked for clock-wise and anti clock-wise sequence of core colors.

4.2 Cables for Conduit Wiring

All cables / wiring in concealed or surface mounted PVC or steel conduits shall be single core PVC insulated of specified grade and size, unless specifically shown on the drawings or given in BOQ.

4.3 Cables on Surface / Concrete Trenches

Cables for distribution system to be installed on surface, in cable ducts, in concrete trenches or on trays shall be single or multicore PVC insulated and PVC sheathed of specified voltage grade and size, unless specifically shown on the drawings or given in BOQ.

4.4 Underground Installation

Cables for laying directly underground shall be PVC insulated, PVC sheathed and armoured with galvanized steel wire. Cables fully installed in underground ducts / pipes and mechanically protected from end to end shall be PVC insulated and PVC sheathed unless specifically shown on the drawings or given in BOQ.

4.5 Cable Accessories

All cable accessories shall be provided for the complete cabling and wiring system without any additional cost unless specifically mentioned in BOQ. These shall include but not limited to the items such as saddles, clamps, fixing channels, connectors, cable joints (where necessary and approved by the Engineer), clips, lugs, tapes, identification tags, bushes, glands, etc.

5. INSTALLATION

5.1 General

When the laying is effectuated by others, the contractor shall test the cable characteristics insulation and continuity, at all phases of these and communicate them in a report to the Engineer, as per recommendations of the standards according to which the cable is manufactured.

The cables shall be spaced by categories along their entire length as well as upon penetration into buildings and in their interiors, according to their following rated voltages:

- 30 cm at least between a cable carrying 1 KV - 30KV and other cables.

- 20 cm at least between a cable carrying voltages between 50V - 500V, and any power or control cable 10 cm at least between a cable carrying voltages lower than 50V and telephone or these possible being grouped.

All installation material, labour, tools and accessories for cable installation shall be furnished by the Contractor. The cable and accessories shall be installed as described in accordance with these specifications, drawings and manufacturer's instructions.

5.2 Conduit Wiring

The wiring through conduit shall be started only after the conduit system is completely installed and all outlet boxes, junction boxes, etc., are fixed in position. The filling rate inside the conduits shall not exceed 40 %. Cables directly embedded in the masonry are not accepted.

The wires shall be pulled in conduit with care, preferably without the use of any lubricant. Where necessary and if approved by the Engineer, the cable manufacturer's recommended lubricant may be used. Where several wires are to be installed in the same conduit, they shall be pulled together along with the earth conductor. All wires of same circuit shall be run in one conduit.

The wires shall not be bent to a radius less than 10 times the overall diameter of the wire, or more if otherwise recommended by the manufacturer.

The wiring shall be continuous between terminations and looping-in system shall be followed throughout. Any joint in wires shall not be allowed. The use of connectors shall only be allowed at locations where looping-in is rendered difficult. The consent of the Engineer shall be required for using connectors. The connector shall be of suitable rating having porcelain body with sunk-in screw terminals. The connector shall be wrapped with PVC insulation tape after its installation. A minimum of 150 mm extra length of cable / wire shall be provided at each termination to facilitate repairs in future.

5.3 Cables on Surface / Trenches

All cables for installation on surface of wall, column, ceiling, trenches, etc., shall be fixed to the surface by means of galvanized steel clips, secured to a steel channel using suitable stud plate, nuts and washers.

The erection of cables and position of support shall be agreed by the Engineer on site, having taken into consideration the accessibility of all such routes. These shall be so arranged that cable crossing one another be minimized if cannot be avoided.

Cables shall be fixed throughout their length by means of approved saddles, clips, etc., at every 600 mm vertically and 900 mm horizontally.

Cables and equipment fixed to a building fabric, i.e., brickwork, concrete, etc., shall be fixed by means of appropriate fixing devices, i.e., Raw bolts, Hilti fixing devices, etc., or alternatively by means of suitable fixing devices cast at site, e.g., concrete inserts.

Contractor shall be responsible for all drilling of steel work, brick work and masonry where necessary for fixing clamps and brackets for supports.

Cables shall not be pulled into conduit until the conduit system has been completed, cleared and free from obstruction and sharp edges.

It shall be ensured that conduit system is clear before cable is drawn in. cables shall be put into conduits in such a manner that there will be no cuts or abrasions in the cable insulation, protective braid and jackets. There shall be no link in the conductors.

Distance of saddles shall be used for installation of cables in defined condition of the surface of wall etc.

Grease or other injurious lubricants shall not be used in pulling cables. The use of talc or non injurious lubricants is permissible, if desirable.

The number of wires installed in any conduit shall be such that the

resulting space factor does not exceed 50 %. Spliced wires shall not be pulled through conduits.

All conduit wiring shall be carried out in the loop - in principle from outlet box to outlet box and in no circumstances shall joints be used except in fixed base connection blocks housed in outlet boxes.

The vertical clearance between two adjacent cables at any point is 50 mm minimum. Common mounting, channels are to be furnished for cable along the same route. The Contractor can offer alternate cable fixing arrangement, which shall be approved by the Engineer before commencement of installation.

The wall crossings where the outdoor cables penetrate in the building shall be carefully obstructed by means of polyurethane foam. The Contractor shall be fully responsible for the perfect tightness of these cable penetrations.

5.4 Underground Cables

The Contractor shall plan and take special care to prevent any damage to existing underground facilities such as underground piping, cables, foundations, etc. The Contractor shall notify the Engineer of any obstruction encountered and shall provide protective support or removal of such obstructions as instructed by the Engineer. Excavation adjacent to existing facilities, such as foundations manholes, ducts, underground pipelines and paving shall be braced and / or shored properly to protect those facilities during excavation and construction.

The cables to be installed directly underground shall be laid in trenches in single tiers. Unless shown specifically on the drawing the depth of cable below finished ground level shall be 900-mm minimum measured from the top of the largest cable to the general ground level. The burial depth may be increased as required due to site conditions or when crossing other service pipes and roads. Burial depth less than 900-mm and more than 1500-mm shall require Engineer's approval.

When cables cross road, paved area, other services or other cables, they shall be laid in protective pipes of required size. Cables entering the buildings shall also be laid in protective pipes. The protective pipes ends, after installation of cables, shall be plugged water tight by means of bitmuisised herisan or equivalent method as approved by the Engineer. A minimum clearance of 250-mm vertically and 500-mm horizontally shall be maintained between cables and other services.

The cable trench shall be excavated as per route and location shown on the drawing. Before lying of cables in the trench, the bed of the trench shall be leveled and filled with a 100-mm thick layer of fine sand (1.3mm diameter maximum particle size). The sand layer shall be

leveled and the cables placed thereon. The cables shall be covered with a layer of fine sand 100-mm thick measured above the top of the largest cable. The cable protective tiles placed above the top of sand cover shall be of class C cement concrete, minimum 50-mm thick and 300-mm x 300-mm in size. The tiles shall be placed over the sand layer end to end to cover the entire length and breadth of the cable trench. After the concrete tiles are placed, the remainder of the trench shall be backfilled with earth in layer 300-mm thick. Each layer shall be thoroughly tamped and compacted.

A PVC warning tape shall be provided at 300-mm below normal ground level covering the entire length and breadth of the trench. The warning tape shall be red in colour with markings of danger and voltage of the cables printed in block.

Sufficient slack shall be left in cables for this purpose that cut lengths of cables shall allow about 3% more in the measured lengths between terminations.

Cables, whether installed underground or in concrete trenches, shall not be bent to a radius less than 10 times the diameter of the cable or as recommended by the cable manufacturer, whichever is higher.

All cables shall be marked at least at each end, switch gear and equipment termination, where cable enter or leave underground cable trenches or channels, where cable rises from one level to another, at 30M intervals with predetermined identification numbers, by means of proprietary non-deteriorating type, PVC, heat shrinkable, strap-on type or equivalent, for the identification of cable and circuit. These shall be indelibly marked with cable number and securely fixed to the cable. Where conductors are left to be terminated by another party or left to be connected later, they shall be identified. The earth continuity conductor shall be laid in the trench with the cables.

5.5 Cable Termination and Joints

Cables shall be terminated in a safe, neat and approved manner at the associated equipment, included that erected by others.

Compression type connectors (lugs) shall be of the correct size and approved type for the conductors concerned. Compression tools shall be supplied for specific use and shall be maintained in good order. After compression the conductor and terminal shall form a solid mass ensuring good conducting properties and mechanical strength. The compression jointing system used throughout the installation must be approved by the Owner or his representative before use.

The Contractor shall be responsible for all drilling and if necessary, tapping entries where these have not been provided by others.

When preparing cables prior to fitting glands, the gland manufacturer's instructions for cable preparation shall be observed. In all cases where armoured cables are used, care shall be taken to ensure that the lay of the armour is maintained after the gland is completely fitted.

Termination and joints shall be suitably insulated for the voltage of the circuits in which they are used.

Every compression joint shall be of a type, which has been the subject of a test certificate as described in BS 4579.

Cable ends, which are not terminated immediately after cutting, shall be sealed effectively to prevent ingress of moisture and shall be protected from damage until termination.

For all cables above 6 sq. mm in section, if a substantial mechanical clamp is not provided a compression type lug or socket shall be provided. At all equipment, cable shall be installed and terminated so that no strain is imposed on the cable or gland and due allowance made to counter the effect of vibration. At all termination an ample length of 'tail' shall be left.

Where joints in cable conductors and bare conductors are required, they shall be mechanically and electrically sound and they shall be accessible for inspection. Joints in non-flexible cables shall be made by means of mechanical clamps or compression type socket, which shall securely retain all the wires of the conductors.

Any joint in flexible cable shall be effected by means of cable coupler. Cable couplers and connectors shall be mechanically and electrically sound and shrouded in metal, which can be earthed. Where the apparatus to be connected require earthing every cable coupler shall have adequate provision for maintaining earth continuity.

Cables of AC circuits, installed in PVC or steel conduit shall always be so bunched that the cables of all phases and the neutral conductor (if any) are contained in the same circuit. The outdoor apparatus shall normally be connected by means of cables with conduit termination down to about 30 cm below ground level or concrete foundation. The conduit shall be firmly secured down to their penetration into the trench or channel.

6.0 TESTS

6.1 Electrical Sample Tests for Insulation & Sheath

6.1.1 The insulation and sheath shall be subjected to following tests:

- i) Installation resistance measurement at room temperature.
- ii) Insulation resistance measurement at maximum rated temperature.
- iii) High voltage alternating current test.

6.1.2 Non-electrical sample tests for insulation & sheath

- i) Measurement of thickness of insulation and sheath.
- ii) Tests for determining the mechanical properties of insulation before and after ageing.
- iii) Weight loss test
- iv) Heat distortion test.
- v) Heat shock test.
- vi) Test for the behaviour of at low temperature (cold bend test).
- vii) Colour fastness test.
- viii) Accelerated water absorption test.
- ix) Resistance to burning.

6.2 Routine Test

6.2.1 Out of all finished lengths, 10% lengths of cables randomly selected shall be subject to the following tests:

- i) Conductor resistance test
- ii) A.C. Voltage

6.2.2 The manufacturer shall maintain record on Routine Tests carried out during the manufacturing process, which may be seen by the inspector while undertaking testing as described in Clause 12.3.1 above.

7.0 TEST SAMPLES, ACCEPTANCE AND REJECTION

7.1 The manufacturer shall afford to the inspector all necessary test facilities and assistance for carrying out the tests. The facilities shall be provided free of charge.

7.2 _____lot
s
shall be so selected that material in a lot is of reasonably uniform quality and as far as possible is manufactured at the same time and under the same conditions. The manufacturer shall keep sufficient production records to ensure that this can be done regularly. The lot size shall consist of any number of lengths upto a maximum as follows:

- 7.3 From each lot regardless of its size, samples of cables shall be taken at random from the following lengths of cables.
- i) Single core/two cores cables 2 lengths
However, if the samples so taken from the offered lots are less than 10 lengths ten 10 lengths shall be subjected to the tests.
 - ii) Four core cables 2 lengths
However, if the samples so taken from the offered lots are less than 5 lengths ten 5 lengths shall be subjected to the tests.
- One sample sufficient to provide the required number of specimens for each test, shall be taken from each cable, single core or multi-core, in each of the selected lengths.
- 7.4 The samples taken shall be subjected to each of the tests prescribed in clause 12.1 and 12.2. The lot shall be accepted, if for each test the sample complies with the requirements of clause e 13.5.
- 7.5 If in any test one sample fails the whole of the respective lot shall be rejected.

8.0 MEASUREMENT AND PAYMENT

8.1 Measurement

The quantities of pay items of cables, which constitute the complete and accepted items shall be measured for payment according to the plans and specification for the several pay items appearing in the Bill of Quantities and in term of the prescribed units provided for the pay items. Only accepted work shall be included for payment and the measured quantity shall be based on the dimension of component as shown on the plans or as directed in writing by the Engineer.

8.2 Payment

The quantities measured as provided above shall be paid for at the unit prices bid for the several pay items appearing in the Bill of Quantities which payment and prices shall be full compensation for furnishing, preparing, fabricating, transporting, placing and erecting all material for the complete structure; for all labor, equipment, tool and all other items necessary for the completion of work. Such payment shall constitute full payment for completed structure and no allowance will be made for false work and other incidental expenses. No separate payment shall be made for work involved within the scope of this section unless specifically stated in the Bill of Quantities or herein.

SECTION - E – 5 LIGHTING FIXTURES

1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete light fixtures as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and positions of light fixtures.

The light fixtures with accessories shall also comply with the General Specifications for Electrical Works, Section - E-1 and with other relevant provisions of the Tender document.

2. GENERAL

The description of light fixtures in given Bill of Quantities, and stated on the drawings, and relevant material are described in this section. The determination of quality is based on certified photo-metric data covering the coefficient of utilization, light distribution curves, construction material, shape, finish, operation, etc.

The Contractor shall submit sample of each and every light fixture specified and obtain approval from the Owner/Engineer before purchasing. The quality and finishes of local make light fixtures (if mentioned in BOQ) shall be same as that of standard manufacturer. The accessories such as ballast, lamp / starter holders, starters, lamps, igniters, etc., for all type of light fixtures shall be of Philips make.

All fixtures shall be finished in standard color schemes as mentioned in the manufacturer's catalogue for respective fixtures, unless specifically stated in the Specifications, Drawings or Bill of Quantities or directed by the Engineer.

3. STANDARDS

Lighting fixtures shall comply with Section E-1, Clause 3.

Particular reference shall be made to:

- IEC 60081 & BS 1853-1 Tubular fluorescent lamps.
- IEC 60082 & BS 2818 Ballast for tubular fluorescent lamps.
- IEC 60155 & BS 3772 Starters for fluorescent lamps.
- IEC 60400 Lamp holders and starters holders for fluorescent lamps.
- IEC 60566 Capacitors for use in TL, HP Mercury and LP sodium vapour.
- IEC 60059 Luminaries.

- BS 3677/3767/4017 Discharge lamp circuits.
- Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 Fluorescent Light Fixtures

The fluorescent light fixtures shall have lamps and ballast of proper rating as shown on the drawings. Each lamp shall be provided with independent ballast.

The fluorescent lamps shall be tubular, TL5 28 / 18 watts respectively as specified. The fluorescent color shall be daylight white characteristics with an average output of 3350 lumens (+5%) for 28 watts and 1350 lumens (+5%) for 18 watts after 100 burning hours. The ballast shall be electronic type for 28 watts ballast. A wiring, diagram, wattage, voltage and current figures shall be printed on the body of the ballast.

The lamp holders shall be rotary lock-in type. The starters shall be glow type with radio interference suppressor / by-pass capacitor. The internal wiring of the fluorescent light fixtures shall be done with heat resistant wires at the manufacturer's factory. All light fixtures shall be provided with power factor improvement capacitor to give a minimum power factor of 0.90.

The body of the fluorescent light fixtures shall be minimum 22 SWG sheet steel, derusted, degreased, finished in heat resistant paint, stove enameled. Appropriate size bushed wire entry holes, fixing holes and earth terminals shall be provided. Connectors suitable for connecting 2.5 sq. mm cable connectors shall be provided for supply connections. An earth terminal for connection to 14 SWG copper conductors shall be provided.

The Fluorescent light fixtures shall be furnished with perspex diffusing panels "040 opal acrylic" (minimum sheet thickness 3 mm), polystyrene louvers or metal grid louvers or mirror optic reflectors, etc. as specified on the drawings or in BOQ. The louvers shall be secured firmly and in level. The polystyrene louvers shall be white Egg Crate or as approved. The louvers shall be in one section and not in pieces.

The design of light fixture for recess mounting shall be coordinated with the design of false ceiling prior to commencement of manufacture. Shop drawings shall be submitted for approval of Engineer.

4.2 Street Light Fixtures

The street light fixtures shall be according to the BOQ. The fixture shall

consist of weather proof, IP-66 rated light weight pressure die-cast aluminum housing, grey stove enameled outside and colored by a molded acrylic cover.

The fitting shall contain a tray carrying all electrical gear. This tray is made of white stove enameled aluminum sheet. The fixture shall have porcelain lamp holder and capacitor.

The ballast shall be polyester resin filled, totally enclosed and shall have leak proof body. The voltage of the lamp and ballast, and a wiring diagram and other relevant data shall be printed on the body of ballast.

The ballast shall be provided with insulated wires. The voltage of the lamp and type of fixture shall be as specified in Bill of Quantities. Light pole of required sizes as mentioned in the BOQ shall be in and out galvanized with all accessories like base plate, nut, anchor bolts, washer (all accessories shall be galvanized) with grey paint over two coats shall be installed as per BOQ.

The Luminaries shall be dust and jet proof, corrosion resistant and resistant to exhaust gases and cleaning detergents.

The single lamp Luminaries shall be designed to house high-pressure sodium lamps. The complete assembly shall provide the required light distribution pattern.

The Luminaries shall be made of pressure aluminum and silicon alloy. The exterior shall be totally smooth. The copper content shall be less 0.05% to prevent inter-crystalline corrosion.

The mirror reflects shall be of either the high-grade anodized aluminum (99.9%) type, or a white lacquered reflector type, rigidly fixed to the body and easily replaceable.

The control gear shall be within the fixture. The lamp and control gear shall be mounted in two different and isolated compartments.

Each luminaries optical compartment or unit shall be protected by a high impact resistant clear glass protector and shall be dust-and watertight to the recommendation of IEC publication No. 144 or approved equal. The protector shall be smooth to reduce to a minimum dirt accumulation and have and maintain a coefficient of transmission of the order of 88% or better.

The front glass shall be provided with corrosion resistant hinges and quick closing devices for easy access for lamp replacement.

The lamp socket shall be made of high-grade porcelain and be provided with a locking system to prevent loosening of the lamp.

The Luminaries shall also be suitable for ceiling mounting under the bridge by means of suitable brackets and clamps.

The materials chosen shall be able to withstand without damage or ageing alteration in their structural or physical properties the severe local environmental conditions in addition to the heat emitted by the lamp.

A suitable terminal block shall be provided to allow connection of the internal wiring and supply cables. Provision shall be made to facilitate maintenance, and easy disconnection and quick replacement of individual components.

The exposed metallic parts of the luminaries shall be factory finished, store enameled with a suitable corrosion resistant paint capable of resisting the heat emitted by the lamp during continuous operation.

The high pressure sodium lamp shall be designed to achieve a long life. The lamps shall have a clear finish and shall have a bayonet-mounting base.

A complement of new lamps of the correct wattage, shapes and rating shall be provided with the luminaries.

5. INSTALLATION

5.1 General

The mounting heights of light fixtures are indicated on the drawings, and position of fixtures according to the mentioned scale.

The Contractor must ensure that the light fixtures are installed uniformly with respect to the dimensions of the area. Any modifications due to site conditions may be made with the approval of Engineer. All fixtures shall be carefully aligned before fixing in position. All fixing accessories such as ceiling rose, flexible cord, lamp holder, suspension rod; pipe or chain with suitable canopy, etc., shall be provided and installed.

The wiring between terminal box and the fixture shall be carried out with 3 core 1.0 sq. mm and 1.5 sq. mm flexible copper conductor,

PVC/PVC cable respectively for circuits protected by 10 amps and 15 / 20 amps MCBs. The wiring inside light fixture body shall be done with heat resistant cables or PVC insulated cable in heat resistant sleeves as approved by the Engineer.

Glasses, shades, reflectors, diffusers, etc., must be in a clear condition after installation.

All light fixtures shall be earthed by an earth wire connected to the earth terminal in the fitting.

5.2 Fluorescent Light Fixtures

The fluorescent light fixtures on the surface of ceiling shall be installed with the back of the body flush with the ceiling surface, and in a manner so as to facilitate wiring. Nylon plugs and galvanized steel bolts or screws shall be used for fixing the light fixture to the ceiling. For light fixtures on installation on false ceiling, the installation method detail shall be coordinated with ceiling design and submitted for approval of Engineer. Care shall be taken to prevent the weight of the fixture from being transferred to the false ceiling.

Pendent light fixtures shall have two holes in the top of each casing by a 1/4" diameter galvanized pipe or any other standard method as approved by the Engineer. Wiring from ceiling rose to the fixture shall be installed through the pipe. Proper arrangements such as long threads with check nuts, etc. for minor adjustment in the mounting heights of the fixtures shall also be provided.

5.3 LED/CFL Light Fixtures

The LED and CFL light fixture shall be installed on the surface of ceiling or wall by means of nylon plugs and galvanized steel screws, such that their back finish flush with the surface for exposed conduits and flush with outlet box for concealed conduit system. Wherever convenient, screws for fixing light fixtures shall be screwed into the holes of the outlet box. The light on false ceiling shall be installed in accordance with manufacturer's recommendations and in coordination with ceiling installation.

5.4 Outdoor Lighting

For illumination around buildings during dark hours, light fittings in various arrangements shall be provided in accordance with these specifications. The items not shown on drawings or called for, but which are necessary for a complete working system as required, these shall also be provided and deemed to have been considered as such.

The Contractor shall essentially use the standard products of a manufacturer, regularly engaged in the manufacturer of the product and shall meet the requirement of the specifications.

6.0 MEASUREMENT AND PAYMENT

6.1 Measurement

The quantities of pay items of light fitting, which constitute the complete and accepted items shall be measured for payment according to the plans and specification for the several pay items appearing in the Bill of Quantities and in term of the prescribed units provided for the pay items. Only accepted work shall be included for payment and the measured quantity shall be based on the dimension of component as shown on the plans or as directed in writing by the Engineer.

6.2 Payment

The quantities measured as provided above shall be paid for at the unit prices bid for the several pay items appearing in the Bill of Quantities which payment and prices shall be full compensation for furnishing, preparing, fabricating, transporting, placing and erecting all material for the complete structure; for all labor, equipment, tool and all other items necessary for the completion of work. Such payment shall constitute full payment for completed structure and no allowance will be made for false work and other incidental expenses. No separate payment shall be made for work involved within the scope of this section unless specifically stated in the Bill of Quantities or herein.

SECTION - E – 6 EARTHING SYSTEM

1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete earthing system as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and positions of the earthing system.

The Earthing system with accessories shall also comply with the General Specifications for Electrical Works, Section E- I and with other relevant provisions of the Tender document.

2. GENERAL

The earthing system consists of earth electrodes, earthing leads, earth connecting points, earth continuity conductors and all accessories necessary for the satisfactory operation of the associated electrical system.

3. STANDARDS

The latest editions of the following standards / codes shall be applicable for the materials covered within the scope of this specification:

BS 951	-	EARTHING CLAMPS
BS 7430	-	EARTHING
BS 2874	-	NUTS,BOLT,WASHER,SCREW & RIVETS FOR USE ON COPPER
BS 1433	-	HARD DRAWN BARE COPPER CONDUCTOR FOR EARTHING.
BS 6346	-	PVC INSULATED CABLES.

Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 Earth Electrode (Plate Type)

The plate type earth electrode shall comprise a (600 x 600 x 3)mm Tinned electrolytic copper plate. The surface of the plate shall be tinned for protection. The plate shall have four terminals for connecting the earthing leads. Nuts, bolts and washers shall be either of brass or tinned copper. A 50mm dia. G.I pipe shall be provided from inspection chamber to earth plate for watering purpose. This pipe shall have 10mm dia. holes at 500mm centre to centre all along the length.

At the ground level an inspection chamber with cast iron cover shall be constructed having dimensions as shown on the drawings. The inspection chamber shall have a cover supported on angle iron frame. The cover shall be hinged type, as approved by the Engineer

and shall finish flush with the ground level.

4.2 Earth Electrode (Rod Type)

This type of earth electrode shall comprise a 3 meter long, 20mm dia. copper rod having flat head at drive end and pointed conical tip at the driven end. The tip shall be hardened to facilitate driving. At the top of the rod, a clamp for bolted connections shall be provided suitable for connection to the down conductor or earthing lead as required.

4.3 Earthing Lead

The earthing lead shall connect the earth electrode to earth connecting point or equipment in the building. It shall be of stranded electrolytic copper. It can be bare or PVC insulated of size shown on the drawings. The cost of earthing leads deemed to have been included in the price of earth electrode and no separate payment shall be made for it.

4.4 Earth Continuity Conductor

Earth continuity conductor (E.C.C) shall be hard drawn bare copper wire or single core PVC insulated copper conductor cable of sizes indicated on the drawings. All thimbles, lugs, sockets, nuts, washers and other accessories necessary for the complete installation of ECC shall be provided by the Contractor without any extra cost.

The specifications for single core PVC insulated cables used as E.C.C. shall be same as those given in section E - 3 low voltage cables and wire of these specifications. When used as E.C.C. shall be green or green/yellow.

5.0 INSTALLATION

Complete earthing systems as shown on the drawing shall be installed by the Contractor. The earthing system shall give earth resistance, including resistance of soil, earth leads and E.C.C. equal to less than one ohm, this without ground pits water spraying.

The earthing system shall be loop connected with earthing cables at least 300 mm away from telephone cables. The concept of the main loops and the way they are connected shall be such that equipment / apparatus can be easily removed without requiring a complex disconnection operation nor risking interruption of / or damage to the loop itself. The fastening of the earthing conductors shall be made on a sufficient length so as to prevent crushing or cross section weakening. The parts on which they are connected shall be conveniently cleansed and surface.

Leads sheaths or steel tape armours are not permitted as grounding conductors. The earthing system shall be installed to ensure that when any part of the earthing system is disconnected for the purpose of carrying out periodic testing an alternative path to earth is available.

At all connections of earth continuity conductor to LV Switchboard, LV Distribution Board or any other metallic body, proper size or brass sockets, thimbles or lugs shall be used to which the copper wire shall be connected by copper brazing. The soldering of copper wire at joints or termination shall not be allowed. All tee-off connections shall be by copper brazing using suitable socket and clamps. After brazing, the jointed surface shall be protected by oxide inhibiting compound of low electrical resistance. For connections to metallic body, the surface shall be thoroughly cleaned before bolting the lug or socket.

The earth continuity conductor shall be in general run in cable trench or in conduits / pipes as shown on the drawings. For under floor runs, these shall be installed in pipe / conduit of appropriate sizes. Where laid along underground cables, these shall be laid directly under ground in unpaved areas and in pipes under paved areas.

5.1 Earth Electrode Plate Type

The electrode plate shall be installed at a minimum depth of 5 meters from finished ground level or 1 meter below permanent water level, whichever is less. The minimum horizontal distance between earth electrodes shall be 3 meters. Proper mixture of lime and charcoal in the ratio of 1:3 shall be made and buried along with the copper plate in the ground to increase the soil conductivity. The electrode shall be installed as per details shown on the drawings. The inspection chambers shall be constructed at locations approved by the Engineer.

A 50 mm diameter G.I. shall be provided from inspection chamber to earth plate for watering purposes. The pipe shall have 10 mm diameter holes at 500 mm center to center all along the length. At the ground level an inspection chamber with cast iron cover shall be constructed having dimensions as shown on the drawings. The inspection chamber shall have a heavy duty cast iron cover on angle iron frame. The cover shall be hinged type, as approved by the Engineer and shall finish flush with the ground level.

The earth connecting point shall be installed at locations shown on the drawings. It shall be fixed on wall surface by means of brass screws with nuts, washers and other insulating material as instructed by the Engineer.

The earth continuity conductor of sizes shown on the drawing shall be installed all along the cable runs and connected to the earthing bar / terminals provided in the equipment. The body of all Switchboards shall be connected to earth by specified size of E.C.C. All metal work shall also be connected to earth by specified size of E.C.C.

At any joint or termination, the E.C.C. shall be connected using proper accessories. No connection shall be made by twisting of earth

conductors.

5.2 Earth Electrode Rod Type

Drive extensible rods of the same diameter into the ground, either manually or by power driven hammer, to a suitable depth to obtain low resistivity in the particular soil.

Weld earth connectors to the top of the rods, in sufficient number to take all incoming cables.

SECTION – E - 7 MV SWITCHGEAR

1.0 SCOPE

The work under this section consists of supplying, installing, testing, connecting, commissioning of all material and services of the complete HT switchboard and Earthing system as specified herein and shown on the Bid Drawings.

The Contractor shall discuss the electrical layout with the Engineer and co-ordinate at site with other services for exact location and position of the H.T. Switchboard and Earthing system.

The HT switchboard and Earthing system with accessories shall also comply with the General Specifications for Electrical Works and with other relevant provisions of the Bid Document.

2.0 GENERAL

2.1 H.T. Switchboard

The HT switchboard shall be sheet steel fabricated, floor mounting cubicle type, indoor, totally enclosed, dust tight and vermin proof, and shall have protection class IP-42. It shall be complete in all respect with material and accessories, factory assembled, tested and finished according to the specifications and to the normal requirements.

The switchboard shall be suitable for front operation only and shall:

- be suitable for addition of units, on either side, in future.
- be provided with adequate clearance from live parts so that flashovers cannot be caused by switching surges, vermin, pests, etc.
- be designed for flush mounting of all instruments on the front side.
- have all incoming and outgoing connections from the bottom.
- have the components mounted so as to facilitate ease of maintenance from the front.
- have provision for lamp test, alarm test, alarm accept and reset facility.
- be mounted on cable trenches having their own supporting structure of angular or U steel profiles.
- be provided with anti-condensate heater, in each individual compartment of cubicle controlled automatically through

adjustable humidistat for maintaining required safe operating condition inside the panel and also avoid condensation. The heater shall also be manually operable and provided with protective miniature circuit breaker and ON indication lamp.

- have stainless steel name plat.
- have bus bar chamber and instrument chamber.
- have pocket for wiring diagram in suitable location/door of instruments chamber.

All pertinent details and drawings shall be provided to the Engineer for approval prior to manufacturing.

3.0 APPLICABLE STANDARDS/CODES

The latest editions of the following standards and codes shall be applicable for the materials within the scope of this section:

IEC 62271-100	High voltage AC circuit breakers
IEC 62271-102	High voltage AC disconnectors and earthing switches
IEC 62271-103	High voltage switches for rated voltage above 1 kV and less than 52 kV
IEC 62271-200	Metal enclosed switchgear and controlgear for rated voltage up to and including 38 kV
IEC 60694	Common specifications for high voltage switchgear and controlgear standards
IEC 60044-1	Instrument transformers – Current transformers
IEC 60044-2	Instrument transformers – Inductive voltage transformers
IEC 60051-1, 2, 3, 5 & 8	Direct acting indicating analogue electrical measuring instruments and their accessories.
IEC 60099-4	Surge arresters: Metal oxide surge arresters without gaps for ac system

4.0 MATERIAL

4.1 HT Switchboard

The switchboard shall be fabricated with angle-iron framework,

welded, grinded, finished and clad with 12 SWG sheet steel. It shall be suitably divided into panels and compartments for accommodating the required number of circuit components, instruments and accessories.

Each cubicle shall be divided in four (04) compartments:

- breaker compartment
- busbar compartment
- H.T. cable connection compartment
- low voltage compartment to accommodate instruments

All instruments, relays, control and selector switches, indicating lamp, push buttons and trip levers shall be flush mounted and located at convenient heights on the front doors of switchgear in logical and clear manner. Means shall be provided to limit the opening angle of doors to about 100°.

The switchboard shall be supplied complete with foundation bolts and other installation materials as recommended by the manufacturer. Proper size cable clamping channels shall be provided for fixing required size of 15 kV XLPE cable. Adequate number of eye bolts shall be provided to facilitate handling.

An earth bar of appropriate cross section to safely carry the fault current shall be provided on full length of H.T switchboard and connected to the body of all sections of the switchboard. The external earth terminal shall be provided for main earth connection. The doors shall be grounded by flexible strap of copper braids.

The control cabling inside the switchboard shall be suitably numbered and harnessed by means of straps or cords. All indicating, selecting and control equipment shall be suitably arranged and clearly labelled with flameproof material using indelible ink/markings, indicating the rating and designation of fuses, switches etc. The nameplates shall be provided on the front of panel for each circuit and component, which is accessible from outside. The nameplates shall be of stainless steel with engraved equipment designation having minimum width of 5mm. Other labeling on the switchboard such as danger signs, voltages, switchboard/panel identification shall be of sufficient size to be legible from a distance of 5 metres.

All metal work of the switchboard shall be cleaned down to bare shining metal phosphated and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of colour RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

4.1.1 Capacity and Basic Data

The switchboard shall be designed to conform but not limited to the following requirements:

drawings.	Rated Current	:	1250A or as shown on
	Rated Nominal Voltage	:	12 kV
	Rated Maximum Voltage	:	12 kV
	Rated Power Frequency Withstand Voltage (r.m.s.)	:	28 kV for 1 minute
	Rated Short Circuit Capacity	:	350 MVA at 12 kV for one second.
	Rated Breaking Current (1 second rating)	:	
	Symmetrical		18.4 kA
	Asymmetrical		22.4 kA
	Rated Peak withstand Current	:	2.55 times rated symmetrical breaking current.
	Operating Duty	:	B-0.3''-MB-3' -MB
	Rated Basic Impulse Level (BIL)	:	75 kV
	Control Voltage	:	
	a) Indication/Metering	:	110 Volt AC from secondary of P.T.
	b) Tripping	:	Series tripping or 110 volt D.C. from capacitor trip unit
Heaters and audible alarm	:	220 V AC from switchboard.	
Auxiliary Contacts	:	Provision for remote indication and/or as required.	

4.1.2 Interlocking

Any interlocking if required inside the HT switchboard and between HT switchboard and other equipment shall be provided as stated on the drawings.

4.2 Bus Bars

The bus bars shall be made of 99.9% pure high conductivity electrolytic finned copper conductors, suitably protected against corrosion, and shall be completely insulated by heat shrink coloured sleeves of specified voltage and mechanically braced to safely withstand the stresses due to short-time momentary current under the fault conditions. The phase identification of bus bars shall be red, yellow and blue by providing colour sleeves at the bus bars ends. The clearances shall not be reduced on account of the bus bar insulation or the phase barriers. The temperature rise shall not exceed 30° C at rated current.

4.3 Circuit Breaker

The circuit breakers shall be triple pole, withdrawable type, with arc interruption in vacuum. The operating characteristics and technical data shall be as given in art. 4.1.1 of this section. The bidder shall submit with his offer the type and details of equipment proposed.

The circuit breaker shall have trip free, direct acting and manually operated drive mechanism. For manual operation a handle shall be provided. The unit shall have rollout trucks and channels for horizontal withdrawal. Interlocking device shall be provided such that the breaker can be closed only when it is in fully plugged-in or fully withdrawn position, and withdrawal of circuit breaker is only possible in the open or isolated position. Safety shutters shall be provided which will automatically cover the live contact as the circuit breaker is withdrawn. Other interlocks as essentially required for safe and proper operation of circuit breaker shall be provided. The circuit breaker phases shall be separated by barriers of approved heat resisting, non-tracking insulating material.

Each circuit breaker shall have a device to register the number of closing operation.

A triple pole grounding switch shall be provided on outgoing panels of H. T Switch Board for cable and bus bars earthing, complete with mechanism for interlocking it with the circuit breaker and the roll-out truck, and mechanical indication to show the position of grounding switch. The grounding switch shall be rated to safely carry the fault current due to inadvertent closing of supply circuit breaker and also for making duty on the fault.

The circuit breaker shall have automatic, mechanically operated 'ON' and 'OFF' position indications. The circuit breakers shall be provided with electrical and mechanical ON-OFF push buttons.

Luminous indications shall be provided on all incoming and outgoing panels, which shall include but not limited to following:

- Circuit Breaker ON
- Circuit Breaker OFF
- Circuit Breaker TRIPPED
- Heater ON

Additional push buttons and indication lamps shall also be provided as shown on drawings and as per requirements

The following instruments and meters shall be installed on the panels as required:

1. One voltmeter with phase selector switch.
2. One ammeter phase selector switch.
3. One kWh meter with M.D.I.
4. One kVARH meter.
5. Power factor meter
6. One IDMT Protection Relay.
7. Hooter
8. Cable termination pad.
9. Signalling lamps.

Each circuit breaker shall be provided with at least three normally closed and three normally open potential free auxiliary contacts rated for 10 Amp, 230V AC as spares. Provision shall be made for remote indication of the circuit breakers position/status.

A test position shall also be provided to facilitate testing operation of circuit breaker manually and by protective relays. Test socket with lug shall be provided for testing the relays.

The circuit breaker shall be complete with necessary secondary wiring with ferrules to indicate the circuit. Protection shall also be provided for all control circuits.

4.4 Current Transformers

Each circuit breaker shall be provided with current transformers having following ratings and characteristics:

- Type : Cast resin
- Number : Three single phase units

- Burden : Suitable for load of protection and instrumentation circuits.
- Accuracy : 5P 20 for protection and 0.5 for measuring with security factor 5.
- Duty : For operating relays/meters and instruments.
- CT ratio : As shown on the Bid Drawings.
- No. of cores : 1 or 2 as required and as shown on Bid drawings.
- Rating and Insulation requirement : As shown on drawings and/or specification in Article 4.1.1
- Rated dynamic current : 2.55 times rated symmetrical short circuit current.

4.5 Potential Transformers

Potential transformers (PT) shall be provided as shown on the Bid Drawings and having the following ratings and characteristics:

- Type : Cast resin
- Number : Three single phase units.
- Burden : Suitable for load of protection and instrumentation circuits min 100 VA.
- Accuracy : Class 0.5 for metering & protection
- Duty : For operating relays/meters and instruments.

PT's shall be designed to have either two independent secondary windings of specified ratio for connection in star or open delta or with a single secondary windings as required and as shown on single line diagram.

- Voltage ratio : $\frac{12 \text{ kV}}{\sqrt{3}} / \frac{110 \text{ V}}{\sqrt{3}} / \frac{110 \text{ V}}{\sqrt{3}}$ for double secondary winding
- : $\frac{12 \text{ kV}}{\sqrt{3}} / \frac{110 \text{ V}}{\sqrt{3}}$ for single secondary winding
- Rated voltage : 1.2 continuous and 1.5 for 30 seconds.

factor

- Rating & insulation: As shown on drawings and/or requirements specification in Article 4.1.1

4.6 Protective relays

The circuit breakers shall be provided with inverse definite minimum time directional or non-directional over-current relays for phase and earth fault protection as shown on drawings. The relays shall have the following common characteristics, unless otherwise specifically mentioned:

- Phase fault over current setting range
 - Inverse : 50-200% of CT secondary rating
 - Instantaneous : 200-800% of CT secondary rating. The instantaneous elements shall also have infinity setting to block their operation, if necessary.
- Ground-fault : 20-80% of CT secondary rating with instantaneous element as for phase fault unit.
- Time setting range: 0-1 second
- Connection : 5 Amp secondary of CT
- Tripping : 110 Volts DC from capacitor trip unit in each breaker panel or series tripping.
- Indications/Control: 110 V AC from secondary of P.T.

The relay shall preferably be triple pole type and have positive action without chatter.

4.7 Surge Protection

Surge Arresters shall be provided in incoming panels of H.T. switchboard The 11 kV surge arrester shall have the following characteristics:

- Voltage Class (highest system voltage) : 12 kV rms
- Service (rated voltage) : 11 / 1.732 kV

rms

This equipment will be tested in accordance with the relevant IEC Standard.

4.8 Capacitor Shunt Trip Unit

In case series tripping is not provided, then each circuit breaker in the H.T. switchboard shall be provided with 110 volts direct current trip coils, which will be supplied power through the capacitor trip units. The trip coils shall be fed through the relay contacts and the 'OFF' push buttons.

The capacitor trip unit will be fed from 110 volts secondary of potential transformer. The capacitor trip unit shall be suitable for performing two successive tripping operations carried out within five minutes. Every circuit breaker shall be provided with a separate capacitor trip unit.

4.9 Meters & Selector Switches

The meters to be provided on HT switchboard are shown on drawings and shall be as specified below:

4.9.1 Ammeter and Voltmeter

The ammeter and voltmeter shall be moving iron spring controlled having front dimensions of 96 x 96 mm. Voltmeters shall have measuring range of 0-15 kV and ammeters measuring range shall be as shown on the drawings. Ammeters and voltmeters shall conform to B.S.S. accuracy class 1.5 and suitable for connection to the secondary of PTs and CTs installed on the switchboard.

4.9.2 Selector Switches

Ammeter selector switch shall be R-Y-B-OFF and voltmeter selector switch RY-YB-BR-OFF. The selector switches shall be complete with front plate and operating lever.

4.9.3 kWh and kVArh Meters

Kilowatt-hour (kWh) and reactive Kilovolt ampere-hour (kVArh) meters shall be suitable for 3 phase, 3 wire, 50 cycles balanced and unbalanced loads. The kWh meter shall also be provided with maximum demand indicator and built in switch for operation at an interval of 30 minutes.

4.9.4 Alarm Indication

On occurrence of any fault in the system and subsequent tripping of circuit breakers, audio alarm shall be provided on the HT Switchboard. Push buttons shall be provided on HT Panel for independent resetting of the audio alarm and fault-indicating lamp. At least two potential free contacts rated 10 Amp AC or DC shall be available for remote connection.

4.9.5 Push Buttons

The push buttons shall be illuminated, momentary make/break contact type or latch type (push-on/push-off) as required and approved by the Engineer and suitable for flush mounting. The push button for ON and OFF switching shall be red and green respectively. They shall be provided as shown on the drawing.

4.9.6 Indicating Lamps

Indicating lamps shall be LED type having long life suitable for flush mounting, complete with base. They shall be suitable for operation on single phase AC and shall have rosettes of suitable colours as approved by the Engineer.

4.10 Insulation Mat

Insulation mat shall be placed in front of the HT panels all along the length. They shall be one meter wide and 6 mm thick and suitable for providing insulation for 15 kV working.

4.11 Danger Boards with Signs & Designation and Shock/First Aid Charts

As per requirements of Pakistan Electricity Rules/Electric Inspector, Danger Boards having signs and designation of the room shall be installed on the external door of each room of the Substation.

Shock/First Aid Charts shall be installed in H.T, L.T, Generator and Transformer Rooms.

5.0 TESTING

All type of routine tests on H.T Switch board, shall be performed at the manufacturer's works in the presence of the Engineer.

The Contractor shall inform the Engineer about the date and time of test of each equipment at least two weeks in advance. This shall, however, be done after the Contractor has got the test procedures duly approved by the Engineer. The witnessing of the test by the Engineer and the Employer shall not absolve the Contractor from his responsibility for the proper functioning of the equipment, and for furnishing the guarantees. All test results shall be

supplied in quadruplicate. All expenses for carrying out the tests as incurred by the Engineer and the Employer to witness is shall be borne by the Contractor.

Upon completion of the installation, the Contractor shall perform field tests on all equipment, materials and systems. All tests shall be conducted in the presence of the Engineer for the purpose of demonstrating equipment or system compliance with Specifications. The Contractor shall submit for Engineer's approval complete details of tests to be performed describing the procedure, test observations and expected results.

6.0 INSTALLATION

The HT switchboard shall be installed at location shown on the drawing. The cable trenches shall be constructed as part of civil works. The Contractor shall co-ordinate with the civil works for providing any openings, holes, etc., in time to avoid any breakage/damage to completed works. In case such provisions in civil works for installation of electrical equipment are not made or made incorrect, the same shall be rectified by the electrical Contractor at his own cost and to the satisfaction and approval of Engineer.

The Contractor shall provide foundation bolts and grout them in cement concrete floor using non-shrinkable material approved by the Engineer. All installation materials for physically erecting the switchboard, such as bolts, nuts, washers, supporting steel, etc. shall be provided and installed by the Contractor. The switchboard shall be installed upright and in level and shall be firmly and rigidly bolted on the floor and concrete supports. All wiring external from HT Switchboard to alarm indication control unit protection interlock circuits and for auxiliary power supply for heaters, etc., will be furnished and installed by the Contractor in consultation with the Engineer.

The switchboard shall be erected as per manufacturer's instructions and as approved by the Engineer. Loose parts dispatched by the manufacturer shall be installed and connected as per assembly drawing provided by the manufacturer. Any safety locking of meters, relays, etc., provided by the manufacturer for safe transport shall be released only after the switchboard is erected in position.

Necessary provision shall be made in the HT switchboard for incoming/outgoing cables, and installation of cable termination kits, keeping in view both cable and switchboard manufacturer's recommendations. The cable armour shall be connected to the earth system.

The switchboard body shall be connected to earth as per instructions given by the Engineer. The switchboard shall be tested and commissioned in the presence of the Engineer. The tests to be carried out shall be as recommended by the International standard to which the switchboard is manufactured.

SECTION – 8

15 KV MEDIUM VOLTAGE CABLE

1.0 SCOPE

The work under this section consists of supplying, installing, testing and commissioning of all material and services of Medium Voltage cable and accessories as specified herein or as stated on the Tender drawings and in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and co-ordinate at site with other services for exact route, location and position of the MV cables.

The Medium Voltage cable with accessories shall also comply with the General Specifications for Electrical Works Section-01 and with other relevant provisions of the Tender Documents.

1.1 GENERAL

The 15kV MV cable shall be three core, Aluminium conductor, cross-linked polyethylene (XLPE) insulated, shielded, armoured as per requirements and overall sheathed. It shall be suitable for indoor and outdoor use in the transmission and distribution of electrical energy.

The cables shall be capable of operating continuously at a conductor temperature of not less than 90oC and shall be suitable for 8.7/15 kV, 50 Hz in three phase grounded system in accordance with IEC 60502.

The cable shall be treated for vermin proofing and be protected against rodents during storage, laying and all protective pipes/ sleeves shall be plugged to attain the same after installation.

1.2 APPLICABLE STANDARD / CODES

The following standards and codes shall be applicable for the materials within the scope of this Section:

IEC 60502 -	Extruded solid electric insulated power cable for rated voltage from 1 kV to 30 kV.
IEC 60540 -	Test methods for insulation and sheaths of electric cables and cords.

IEC 60228 -	For resistance of conductors.
IEC 60332-1 -	For flame retardant test.
IEC 60332-3	For fire resistant test on fire resistant cables.
IEC 60227 -	For core identification by colours

1.3 MATERIAL

1.3.1 15kV Cable

The cable shall meet the following specifications:

Nominal/System Voltage -	12 kV
Frequency-	50 Hz
Conductor Size-	Sq.mm. As given in BOQ,
Number of Cores-	3
Rated Voltage -	8.7 / 15kV
Continuous operating Temperature of conductor -	90°C
Conductor material-	Aluminium stranded
Insulation-	Cross-linked polyethylene (XLPE)
Shielding-	Aluminium tape
Jacket -	PVC
Armouring-	Galvanized steel wire
Over sheathing-	Extruded PVC
Phase identification-	Red, Yellow, Blue

1.3.2 Conductor

The conductors shall be of high conductivity electrolytic Aluminium, stranded in accordance with specified standard.

1.3.3 Insulation

The insulation shall be cross-linked polyethylene extruded over the conductor. The insulation shall be laid to avoid any gap/air pockets between the conductor and insulation. The insulation shall be colour coded red, yellow and blue for phase identification.

The insulation shall be easy to strip from individual conductors and to separate for jointing/termination purposes.

1.3.4 Shielding

Each core shall be shielded by a layer of semi-conducting material applied directly over the insulation. The semi-conducting insulation shall be covered by a bare copper tape applied with suitable overlapping.

Phase identification tape of red, yellow and blue colours shall be wrapped over the copper shield.

1.3.5 Assembly

The three insulated conductors shall be assembled with PVC or any non-hydroscopic filler and bounded with tape. The tape binder shall then be covered with extruded PVC jacket. The PVC jacket shall be padded with a suitable material before application of armour.

1.3.6 Armour

Armouring shall be provided with single layer of galvanized steel wire to provide cable protection and also act as a low resistance earth return path. The armouring shall be covered with binder tape. The armour shall be of appropriate size to carry the system fault current.

1.3.7 Over sheath

The entire cable assembly shall be covered with a PVC jacket

of thickness not less than 2.5 mm. The colour of the jacket shall be black.

Embossed marking on the over sheath at 3 meters intervals shall give the following information:

- Name of Manufacturer
- Year of Manufacture
- Size of cable in sq.mm.
- Voltage grade
- Type of cable i.e. Cu., XLPE/SWA/PVC

1.3.8 Factory Tests

Physical and electrical acceptance tests in accordance with applicable standard shall be carried out at the manufacturer works in the presence of Engineer. Three copies of test reports will be furnished to the Engineer, which shall include brief description of tests, test records and results.

1.3.9 Termination Kits

Termination kits for 15 kV cable shall be indoor/outdoor type as per requirement and recommended by cable manufacturer and as approved by Engineer. The termination kits shall be complete with all materials.

1.3.10 Cable Accessories

All cable accessories shall be provided for the complete cabling system without any additional cost unless specifically mentioned in BOQ. These shall include but not limited to the items such as saddles, clamps, fixing channels, connectors, clips, lugs, tapes, solder identification tags, bushes, glands etc.

1.3.11 Cable Reels

The cable shall be supplied in non-returnable, mechanically strong, sea/rail/ road worthy, wooden or metallic cable drums, protected against weather. The cable drum should bear the markings for cable type, cable size, voltage grade, year of manufacture, name of manufacturer, direction of unreeling, and

any other additional marking normally provided by the manufacturer. Cable ends on cable reels shall be protected by means of suitable seal.

1.3.12 Cable Markers

Above ground cable markers made of Grade-25 reinforced concrete shall be erected at a maximum interval of 200 metres along the straight trench, at each bend and joint box for indicating the presence of underground cables. Where the trench changes its direction two number of markers shall be installed one in each direction to indicate the two directions of the trench. At the joint box, additionally a symbol shall be engraved just beneath the letters MV or LV to indicate the presence of the joint box.

The cable markers shall be finished in grey paint. The letters and symbols for indication shall be engraved in concrete on both sides. Letters shall be MV or LV for medium voltage or low voltage cable. The colour of the engraved letters and symbol shall be black. The dimensions of the markers shall be as shown on the drawing and shall be installed in the ground as shown.

1.4 INSTALLATION

1.4.1 General

All installation material, labour, tools and accessories for cable installation shall be furnished by the Contractor. The cable and accessories shall be installed as described in these Specifications, drawings and in accordance with manufacturer's instructions.

Necessary precautions for safety of cables shall be taken during the laying of cables to avoid scratches/ cuts to the cable surface. Pulling force on cable at all times shall remain well within the manufacturer's recommended limits.

The exact cut lengths for cable shall be confirmed by the Contractor by actual measurements at site prior to the commencement of manufacturing. The cable lengths where shown on the drawing are tentative and only for general guidance. The Contractor shall be solely responsible for furnishing correct lengths of cable to avoid joints in cable length except where necessary, after obtaining approval of the Engineer.

No separate payment for such joints shall be admissible.

Prior to installation of jointing and termination kits, the cable lengths shall be checked and tested to ensure that the cables are in sound condition, and no damage has been done during handling and installation. After the H.T. cable and jointing/termination kits are installed, it shall again be tested prior to commissioning and in accordance with recommendations of standard to which the cable is manufactured.

1.4.2 Underground Cables

The cables to be installed directly underground shall be laid in trenches in single tiers. Unless shown specifically on the drawing the depth of cable below finished ground level shall be 900 mm minimum measured from the top of the largest cable to the general ground level. The burial depth may be increased as required due to site conditions or when crossing other service pipes and roads. Burial depth less than 900mm and more than 1500mm shall require Engineer's approval.

When cables cross road, paved area, other services or other cables, they shall be laid in protective pipes of required size. Cables entering the buildings shall also be laid in protective pipes. All the protective pipe ends, after installation of cables, shall be plugged water tight by means of sealant as approved by the Engineer. A minimum clearance of 250mm vertically and 500mm horizontally shall be maintained between cables and other services.

The cable trench shall be excavated as per route and location shown on the drawing. Before laying of cables in the trench, the bed of the trench shall be leveled and filled with a 100mm thick layer of fine sand (1.3mm diameter maximum particles size). The sand layer shall be levelled and the cables placed thereon. The cables shall be covered with a layer of fine sand 100mm thick measured above the top of the largest cable. The cable protective tiles placed above the top of sand cover shall be of class-C cement concrete, minimum 50mm thick and 300mm square. Good quality bricks of proper strength and shape, well formed can also be used for the purpose of protection. The tiles or bricks shall be placed over the sand layer end to end to cover the entire length and breadth of the cable trench. After the concrete tiles/ bricks are placed, the remainder of the trench shall be backfilled with earth in layer 300mm thick. Each layer

shall be thoroughly tamped and compacted.

A PVC warning tape shall be provided at 300 mm below normal ground level covering the entire length and breadth of the trench. The warning tape shall be yellow in colour with markings of danger and voltage of the cables printed in black.

Cable identification tags of water resistant material with indelible marking shall be fixed to cables with ties at a maximum of 20 metres interval along the cable length for identification of cable and circuit. The earth continuity conductor/ counterpoise conductor shall be laid in the trench with the cable. The Contractor shall submit to the Engineer for approval, schedule of cable markers showing location of marker and instructions on each.

Sufficient slack shall be left in cables for which purpose the cut lengths of cables shall allow about 3% more in the measured lengths between terminations. At underground joint box, ample slack shall be left to prevent straining of cable joints due to settlement of the cable trench.

The cut lengths of cables wherever stated are only as a guide. The Contractor shall measure lengths between terminations of each circuit and if the discrepancy between measured lengths at site and where given on the drawing differ by more than 5%, the Contractor shall report to Engineer and act as directed. Cables, whether installed underground, or in cement concrete trenches, shall not be bent to a radius less than that recommended by the cable manufacturers.

1.4.3 Cable Marker

The cable marker shall be installed on finally compacted trench at mentioned distances.

Above ground, cable markers shall be erected at a 200 metre interval along the straight trench, and at each bend and joint box for indication of presence of underground cable. For more than one metre wide trenches, cable markers shall be provided at both edges of the trench. The cable marker shall bear the necessary instructions indicated in approved colours.

The Contractor shall submit to the Engineer for approval, schedule of cable markers showing location of marker and instructions on each marker

LIST OF APPROVED MANUFACTURER

*** All Equipment shall be procured from Principal Authorized agents / distributors / resellers**

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

At the evaluation stage if it is noted that any material offered by the bidder does not meet the specification requirements, the Engineer / Owner reserves the right to ask the bidder to replace his choice of equipment supplier meeting the required quality and specification requirement.

During the execution stage if the material from any supplier is found defective / substandard the Engineer / Owner reserves the right to ask the successful bidder to replace his choice of manufacturer / supplier for that particular equipment.

Any change in manufacturer / supplier shall only be entertained if there is sufficient reason that adhering to the original choice of manufacturer / supplier shall be detrimental to either the project quality or project timeline. Proper approval shall have to be sought for change in the choiced manufacturer / supplier at least 1 month before the equipment is to be procured.

Samples of all equipments shall have to be got approved prior to their procurement. The bidder has to sign and stamp all pages of Annexure-1. Any deviation from the BoQ / Specification shall be listed in a separate sheet to be labeled as Annexure-2 containing the details of the deviation including the deviating BoQ item number.

S.No.	Manufacturer / Supplier	Country Of Origin
-------	-------------------------	-------------------

(To be filled in by the Bidder)

MEDIUM VOLTAGE (MV) PRODUCTS

MV Switchgear

- | | | |
|----|----------------------------|----------|
| a. | Siemens | Pakistan |
| b. | Pak Electron Limited (PEL) | Pakistan |
| c. | Schneider Electric | Pakistan |

MV Cables

- | | | |
|----|-----------------|----------|
| a. | Pakistan Cables | Pakistan |
| b. | Pioneer Cables | Pakistan |
| c. | Newage Cables | Pakistan |

MV Cables Accessories (Jointing & Termination Kits)

- | | | |
|----|---------|---------|
| a. | 3M | USA |
| b. | Raychem | Germany |

L.T.-C.T./ P.T

- | | | |
|----|------|----------|
| a. | PEL | Pakistan |
| b. | Fico | Pakistan |

H.T.-C.T./ P.T

- | | | |
|----|---------|----------|
| a. | Revalco | Italy |
| b. | Fico | Pakistan |

Relay

- | | |
|-----------|---------|
| Schneider | France |
| Siemens | Germany |

LOW VOLTAGE (LV) PRODUCTS

LV Switchboards / Distribution Boards / PFI Panels/lighting Control panel

- | | | |
|----|----------------------------|----------|
| a. | Pak Electron Limited (PEL) | Pakistan |
| b. | Siemens | Pakistan |
| c. | Schneider Electric | Pakistan |

Circuit Breakers

- | | | |
|----|---------------------------|---------|
| a. | M.G. (Schneider Electric) | France |
| b. | Terasaki | Japan |
| c. | ABB | Germany |
| d. | General Electric (GE) | USA |
| e. | Siemens | Germany |

Load Break Switches, Changeover Switches

- | | | |
|----|----------------|------------|
| a. | Socomec | France |
| b. | Kraus & Naimer | Newzealand |

Push Buttons, Switches, Etc.

- | | | |
|----|--------------------|------------------------------|
| a. | Schneider Electric | France |
| b. | Maruyasa | Japan / Malaysia / Indonesia |

LV Cables & Wires

- | | | |
|----|-----------------|----------|
| a. | Pakistan Cables | Pakistan |
| b. | Pioneer Cables | Pakistan |
| c. | Allied Cables | Pakistan |
| d. | AGE Cables | Pakistan |

- e. Fast Cables Pakistan

Cable Glands, Lugs, Terminals and Accessories

- a. Cembre UK
- b. Hubbell / Hawke UK

PVC Conduits and Accessories

- a. Galco Pakistan
- b. Dadex Pakistan
- c. Jeddah Polymer Pakistan

Back Boxes

- a. Hussain & Co. Pakistan
- b. Ezzi Engineering Pakistan

Switch & Socket Outlets / Floor Boxes

- a. Clipsal (Schneider Electric) Australia
- b. M.K. UK
- c. Legrand UK
- d. ABB Germany

FAN & Accessories

- a. Pak Fan Pakistan
- b. GFC Pakistan
- b. Millat Fan Pakistan

Lighting Fixtures

- a. Philips Pakistan
- b. Britlite Pakistan
- c. Ohms Pakistan
- d. Pierlite Pakistan

Earthing

- a. Furse UK
- b. Erico USA
- c. Wallis USA

VOLUME-III
BILL OF QUANTITIES

PREAMBLE TO PRICING AND METHOD OF MEASUREMENTS

BILL OF QUANTITIES

PREAMBLE TO PRICING AND METHOD OF MEASUREMENTS

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PREAMBLE TO PRICING AND METHOD OF MEASUREMENTS

Generally

The Bill of Quantities herein, including all notes and instructions, forms an integral part of the Bid/Contract Documents. However, the descriptions contained in the Bill of Quantities for each item are not necessarily complete. The Contractor is referred to the Conditions of the Contract and other Documents, Specifications and Drawings as well as relevant Standards and Codes of Practice for further information as no claim or variation will be considered on account of the Contractor's failure to do so.

The Contractor is cautioned to familiarize himself with the full content of other Contract Documents including the Instructions to Bidders, Bid Form, General Conditions, Particular Conditions, Bid / Contract Drawings and Specifications or any other information that can be easily inferred from any of them and all obligations contained in the documents shall be included in the item rates and / or contract price.

Drawings, Specifications and Bill of Quantities and all other documents are complementary and if description of any item is included in any of them, it shall be deemed included in all.

The Contractor's bid for the entire work shall provide for supervision of any or all trades that are intended to be performed with his own forces, his domestic sub-contractors and nominated sub-contractors. No extra compensation for services as a General Contractor will be paid.

The Contractor shall not use these Bills of Quantities as the basis for a construction program or for the purposes of ordering materials or arranging sub-contracts. The references for these activities shall be the drawings, specifications and instructions issued by the Engineer.

This is a Measurable type of Contract. The quantities contained within these Bills of Quantities may not accurately reflect the quantities of works as indicated in the drawings, Specification and Package Scope. The contractor is to satisfy himself for the accuracy of all quantities. No claim will be entertained for differences in quantities between the Tender Drawings, Specification and Bills of Quantities.

Items in the Preamble Section of these Bills of Quantities are deemed to qualify and to form part of description of measured work to which they refer including composite description.

All measurements are net and the rates shall include for all laps, waste, working space, etc. and trade or traditional allowances.

Amendments shall not be made to these Bills of Quantities without the authority, in writing of the Engineer.

A price or rate is to be entered against each item in the Bills of Quantities. The cost of any item left un-priced will be deemed to be included for elsewhere in the Bills of Quantities, and the rate for the un-priced item will be taken as nil. Any item of the Day Works if not entered by the Bidder shall have to be carried out at the Rate as decided by the Engineer.

For the general guidance of the bidders the relevant CSI Section numbers have been mentioned in the beginning of each Bill/Division/Section. This does not absolve the Bidder's responsibility to confirm and price according to the appropriate BSI/ASTM/CSI code applicable to any item mentioned in the Bill of Quantities and drawings etc.

Method of Measurement

The quantities in the Bill of Quantities have been prepared generally in accordance with the **Principles of Measurement (International) for works of construction dated June 1979 / Standard Method of Measurement of Building Works (SMM 7) seventh edition year 1988, published by the Royal Institution of Chartered Surveyors, 12 Great George Street, Parliament Square, London SW1P 3AD, U.K. amended to suit the local practice and conditions.** The description of each item (which description shall imply references to any heading, sub-heading, preamble or other clause of item which shall apply) shall be held to include all claims, materials, workmanship, including all taxes, duties, charges, all Government levies, landing charges, transport, profit and overheads and all other incidental costs to complete the Works.

These preambles are to be read in conjunction with the item description in the Bill of Quantities.

“As described” means as directed in the Specifications and / or Drawings.

Unless otherwise described or measured separately, prices for all items shall include for all necessary straight, raking or circular cutting.

The Conditions of Contract applicable to this Contract is as specified in Volume 1 – Tender & Contract Conditions of the Tender and Contract Document.

Pricing

The prices shall be comprehensive and must include for complying in all respects with the instructions to Bidder, Conditions of Contract, Specifications, and Drawings and for all matters and things necessary for the proper construction and completion of the whole of the Works. No claim for additional payment will be allowed for any error or misunderstanding by the Contractor of the work involved.

The rates and sums inserted in the Bills of Quantities are deemed to include for the following:

- (i) Labor and all costs in connection therewith.
- (ii) Materials, goods and all costs in connection therewith (e.g. carriage, freight, delivery, unloading, storing, returning packing handling, Letters of Credit, Bank Guarantees, Bank charges and the like, Customs duties, port dues, import duties, taxes, charges, Insurances and other dues levied by any authority or imposed by the Government, hoisting or lowering, replacing work, goods or materials damaged, broken, lost or stolen until the issue of a Certificate of Completion.
- (iii) Fittings and fixing materials or goods in position.
- (iv) Plant.
- (v) Waste, bulking, shrinkage and overlaps.
- (vi) Land required for tips and stockpiles including all costs for obtaining any necessary licenses and approvals.
- (vii) Allowance for phasing requirements of works, effect on programming of the works of all traffic diversions and construction activity associated with diversion or installation of services.
- (viii) For taking measures for the support and full protection of pipes, cables and other apparatus required during the progress of the Works as required by Service Authority or the Engineer.
- (ix) For working alongside and liaising with other Contractors working on the same site.
- (x) Preparation and submission of shop drawings.
- (xi) Overhead charges and profit.
- (xii) Guarantees and warranties where necessary.
- (xiii) Temporary works, if any.

Lump sums shall not be given where unit rates are applicable.

Where the word “allow” is used, the cost of the item shall be the responsibility of the Contractor.

The amounts set against any items of overhead shall include for all costs in connection with letters of credit, bank charges, interest charges and insurance after the materials come under the control of the Contractor.

The rates inserted will be used to determine the amount of the Contractor's Interim Payments.

The Bidder shall submit the full and detailed rate breakdown of all the BOQ items including spare parts items in the format as per enclosed Annexure-1, together with their Bid submission. The breakdown is to show the actual calculations of the General Items, Labor, Plant and Materials costs for the Works, the build-up of measured rates with on-costs and site and Head Office overheads and any other allowances used to arrive at the Bid Price. In addition the Bidder will be required to provide the Engineer within 48 hours with a full and detailed breakdown/any other information if requested. The purpose of this Breakdown/Rate Analysis is to make sure that (i) the rates used in the analysis of the items of permanent works and those quoted in the Day Works are reciprocal to each other, (ii) the bid is not front loaded, and (iii) the markup of Overheads & profit is uniform throughout the bid.

Where "fix only" items are specified, the rate shall be deemed to include for taking delivery, storing and installation of goods or materials in works where appropriate.

The rates inserted in the Schedule of Day work shall be deemed to be the rates used by the Contractor in making up rates for works items in all Parts of the Bills of Quantities.

Adjustment Item

The adjustment item, if any, addition or deduction, shall apply to all Bill items, excluding provisional sum unless clearly indicated otherwise. The adjustment item shall not be a lump sum, but a percentage of the total Bid amount excluding provisional sum or a percentage of the total for the items indicated. The adjustment items shall be applied to all applicable item rates and sums entered in the Bills of Quantities (including any addenda). The adjusted rates and sums shall be applied for the valuation of Variations.

General Requirements

Standards

Where no reference is made to a code, standard or Specifications in Section "B" Specifications of the SUB-CONTRACT Documents, the Standard Specifications of the American Society of Testing Materials, (ASTM), British Standard Codes of Practice (BSCP) or any other relevant standard as approved by the EMPLOYER shall govern.

Drawings

The WORK shall agree in all particulars with the Drawings or any approved modifications of them or such other drawings as may be issued during the SUB-CONTRACT.

The EMPLOYER will supply two copies of each of the drawings to the CONTRACTOR free of charge.

The CONTRACTOR will make any further copies required by him at his own expense.

The CONTRACTOR will keep one set of all drawings duly mounted with muslin cloth and hanged on the wooden drawings stand when not in use.

CONTRACTOR'S (Drawings & Documents)

The CONTRACTOR shall submit three prints/copies of all drawings, documents and schedules to be prepared by him. These will be of a standard size and format acceptable to the EMPLOYER. All such submission by the CONTRACTOR shall be accompanied by a letter of submittal.

Record Drawings

The CONTRACTOR shall prepare during the progress of the SUB-CONTRACT, drawings showing the WORK "as built" including the positions of all services, plant and equipment. The drawings shall be prepared to a form & detail to the satisfaction of the EMPLOYER and prints shall be submitted to the EMPLOYER'S REPRESENTATIVE for his approval as the WORK proceeds. At the completion of the SUB-CONTRACT the CONTRACTOR shall supply to the EMPLOYER reproducible of each drawing.

Supply of Water and Electricity

The CONTRACTOR shall make his own arrangements for the provision of water & electricity whether for use in the execution and construction of the WORK or otherwise. In the event of the source of water being from any existing piped supply the CONTRACTOR shall comply with any regulations laid down by the Water Authority and shall pay for such supply, stand-pipe connections, meter rents and all other charges as required all at his own expense. Similarly he will be responsible for all costs in providing electricity. Where electricity is not available for 24 hours, diesel/petrol driven electricity generators in good and reliable condition and of sufficient capacity to meet the requirements of construction equipment and lighting and other facilities at Site will be used by the CONTRACTOR.

Disposal of Wastes

The CONTRACTOR shall make adequate arrangements to the satisfaction of the EMPLOYER'S REPRESENTATIVE for disposal of all sewage, rubbish and all other waste material arising from or connected with the execution of the WORK.

Other Services

The CONTRACTOR shall make his own arrangements for and shall provide any service (including telephone) which may require in addition to the foregoing.

Bench Marks and Control Points

All levels, lines, grades and measurements shown on the Drawings shall be measured from a Bench Mark and points to be established by the EMPLOYER within the Points Site of the WORK. The CONTRACTOR shall be responsible for ensuring the levels of all parts of the work are accurately related to this Bench Mark which shall be notified to the CONTRACTOR by the EMPLOYER immediately after commencement of the WORK.

Survey

The CONTRACTOR shall furnish and maintain at his own expense survey instruments stakes and other such materials and give such assistance, including qualified staff as may be required by the EMPLOYER who will establish Bench Marks base lines, grades and other principal control points. The CONTRACTOR shall, however, call the EMPLOYER'S attention to any inaccuracies and discrepancies of such controlling points etc., before proceeding with the work. The CONTRACTOR shall at his own expense, establish working or construction lines and grades as required, which shall be frequently checked by the EMPLOYER'S REPRESENTATIVE but the CONTRACTOR shall be solely responsible for the accuracy thereof.

Safeguarding Bench Marks & Control Points

The CONTRACTOR shall safeguard all points, stakes, grade marks and bench marks made or established on the work. If disturbed he shall bear the cost of re-establishing them and also the entire Points expense of rectifying the work rendered defective due to such disturbance.

Progress Photograph

The CONTRACTOR shall, throughout the construction of the WORK use digital camera for photography and provide the progress photographs in color to the EMPLOYER. He will also submit three prints each of size 5"x7" along with the recorded data at two week intervals. All such photographs will be taken under the direction of the EMPLOYER.

Materials and Workmanship

As soon as possible after the SUB-CONTRACT has been awarded, the CONTRACTOR shall submit to EMPLOYER list of suppliers from whom he proposes to purchase the materials necessary for the execution of the WORK. The information regarding the names of suppliers may be submitted at different times, as may be convenient, but no approved source of supply shall be changed without the prior permission of the EMPLOYER'S REPRESENTATIVE.

Preference shall be given to the use of materials and fittings manufactured in Pakistan which comply with the SUB-CONTRACT and are competitive in price. Foreign materials shall only be used with the consent of the EMPLOYER.

All materials incorporated in the WORK shall be new and of the best quality and description of their respective kinds and shall comply with all relevant specifications. Similarly the workmanship in every case shall be of the best character, and the whole shall be subject to the approval of the EMPLOYER.

Materials whose quality and construction are not covered by the Technical Specifications shall be of equal or better quality than the relevant sample accepted by the EMPLOYER'S REPRESENTATIVE.

Samples

In addition to any special provisions herein for the sampling and testing of materials, the CONTRACTOR shall submit to the EMPLOYER as he may require samples of all materials and goods which he proposes to use or employ in or for the WORK. Such samples, if approved, will be retained by the EMPLOYER'S REPRESENTATIVE, and no materials or goods of which samples have been submitted shall be used on the WORK unless and until such samples have been approved in writing by the EMPLOYER.

The EMPLOYER'S REPRESENTATIVE may reject any materials and goods which in his opinion are inferior to the samples thereof previously approved and the CONTRACTOR shall promptly remove such materials and goods from the Site.

The cost of supplying all such samples and of conveying same to such place of inspection or testing as the EMPLOYER may designate within the country of origin shall be deemed to be included in the tendered rates and prices.

Samples will be retained by the EMPLOYER and when directed by the EMPLOYER'S REPRESENTATIVE the CONTRACTOR shall dispose of the samples. Except for those which may be incorporated into the WORK after approval, such as plumbing and electric fixtures.

Tests Generally, Access to Premises

The EMPLOYER may examine and may require to be tested any materials or goods required in or for the WORK such as he may decide from time to time and shall have unrestricted access to the CONTRACTOR'S, CONTRACTOR'S and supplier's premises for such purpose at all times and the CONTRACTOR shall specify this requirement when placing all orders.

The EMPLOYER will notify the CONTRACTOR whether materials and goods will be inspected at the manufacturer's or supplier's premises or at the Site. No materials or goods shall be dispatched from such premises until such notification is given and, if appropriate, inspection is complete and a release certificate is given to this effect. In both cases the CONTRACTOR is to notify the EMPLOYER when materials and good will be ready for inspection and shall do so adequately in advance for him to make the necessary arrangement for inspection.

The CONTRACTOR shall afford the EMPLOYER all facilities, assistance, labor and appliances necessary for the convenient examination, testing weighing or analysis of all such materials or goods. The CONTRACTOR shall provide and prepare such test pieces of any such materials or goods as the EMPLOYER may require.

Notwithstanding any tests which may have been carried out off the Site the EMPLOYER shall be empowered to order further tests of any materials or goods to be made on the Site and to reject such materials or goods should they fail to pass such test on the Site.

The full cost of providing all facilities, labor, consumable stores and appliances required in connection with all testing on the Site shall be deemed to be included in the tendered rates and prices.

Test Certificates

Should the EMPLOYER not inspect any materials or goods at the place of manufacture, the CONTRACTOR shall, if required, obtain certificates of test from the suppliers of such materials or goods and shall send such certificates to the EMPLOYER. Such certificates shall certify that the materials or goods concerned have been tested in accordance with the requirements of the Technical Specifications and shall show the results of all the tests carried out. The CONTRACTOR shall provide adequate means of identifying the materials & goods delivered to the Site with the corresponding certificates.

Testing at an independent Laboratory

Where tests are specified or directed by the EMPLOYER to be carried out in an independent testing laboratory, the CONTRACTOR shall supply and deliver the samples and shall arrange for the relevant tests to be carried out. The independent testing laboratory shall be nominated by the CONTRACTOR and acceptable to the EMPLOYER. Unless otherwise specified the CONTRACTOR shall arrange for one copy each of the independent testing laboratory's test certificates to be delivered to the EMPLOYER and to the EMPLOYER not less than 3 working days before the materials covered by the relevant test certificates are to be incorporated in the WORK. Each test certificate shall be relatable to the materials from which the sample was taken.

Site Testing

The CONTRACTOR shall carry out such laboratory and field test (including tests to check the accuracy of testing equipment and methods but excluding tests specified to be carried out in an independent testing laboratory) as specified or as can reasonably be inferred from herein, as may be necessary to ensure and satisfy the EMPLOYER that the requirements of the Technical Specifications are met. The type and frequency of testing shall be in accordance with the relevant standards except as otherwise specified herein or directed by the EMPLOYER.

The CONTRACTOR'S attention is drawn to the fact that the frequencies of testing specified in the relevant clauses are intended to represent only a general guide. The EMPLOYER shall be empowered to vary the frequencies at which tests are conducted should he deem this necessary for the proper control of the quality of the WORK. Should the EMPLOYER'S REPRESENTATIVE vary the frequencies stated in the relevant clauses of the Technical Specifications, the CONTRACTOR shall not be entitled to extra payments thereof.

Unless otherwise agreed or directed by the EMPLOYER methods of sampling and test procedures shall be in accordance with the relevant Standard Methods of ASTM, British Standard Codes of Practice or any other relevant standard approved by the EMPLOYERS. Sample will be selected by the EMPLOYER'S REPRESENTATIVE.

The CONTRACTOR shall keep clear, accurate and up-to-date records of tests and immediately any test is completed shall supply two copies and summaries of the results thereof to the EMPLOYER'S REPRESENTATIVE in such form as he may require. Testing equipment operations and records shall be available for inspection by the EMPLOYER'S REPRESENTATIVE at all times.

Removal of Condemned Materials

The EMPLOYER'S REPRESENTATIVE may require the CONTRACTOR to remove and dispose of any materials employed of the EMPLOYER'S REPRESENTATIVE, are unsuitable or have been incorrectly deposited or have suffered damage by exposure to the weather or otherwise are not in accordance with the specified requirements for such materials. The CONTRACTOR shall be entitled to no payment whatsoever in respect of such materials.

Contractor and Engineer's Site Offices

- i- Contractor shall provide and maintain a temporary, weather tight site office for his own use and that for Engineer's use complete with facilities for filing, drawings, specifications correspondence, and other appurtenances necessary for the proper execution of the Work. The Contractor shall make provision for transportation and off-site living accommodation for his personnel and provide necessary power, water, sanitary facilities, necessary for his personnel, equipment cartage and materials operations. Facilities shall be as approved by the Engineer.
- ii- contractor at his own cost shall provide, erect and maintain an office facility at Site for the sole use of the Engineer's/Consultant's Staff. Facility shall be serviced with power, potable filtered water, lighting, air conditioning, telephone connection, sewerage and waste disposal facilities, during the entire construction phase and up to six months from the date of Substantial Completion, of the type as follows:

Office facility shall be temporary type weather-tight construction having a total floor area of not less than 500 sq. ft. And shall be air conditioned and have attached meeting room as well as a washroom containing W.C., urinal and washbasin. A mobile shipping container designed for the above purpose in accordance to the requirements of the Engineer, shall be acceptable.

Furniture, Equipment etc. for Site Office: All necessary office furniture, including filing facilities for two junior and one senior staff of Engineer/ Consultant should also be provided.

Computer & Printer: The contractor shall provide a latest PENTIUM IV computer with laser color printer with all peripherals as required by the Engineer, printer to be capable of printing A-3 size sheets, fax machine, photo copier capable of copying up to A-3 size sheet: (powder copies)

Furniture

One Table Approx. 5' x 3' , two tables of approx. size 4' x 2' 6"

One good quality revolving Chair, and six Nos. Good quality non-revolving chairs.

Drawings Stand for holding 30 drawings.

An Internet/E-mail account

As per the requirement of the Engineer for exclusive use of Engineer/consultant and their staff

Telephone & Fax

A separate telephone line for fax machine shall be provided by the Contractor. The maintenance and the stationary of the entire aforesaid facilities shall solely be the responsibility of the contractor

Transportation facility

The contractor shall provide a minimum 1000 cc brand new vehicle, along with driver and POL, (to be transferred to the employer after successful completion of the project) in connection with performance of official duties, exclusively for the Resident Engineer.

The contractor shall also provide adequate transportation facility in connection to performance of official duties, exclusively for the site staff of the Engineer/Consultant during the construction as well as the extended period (if any) as and when required by the Engineer/ Consultant.

For both the above items the Contractor shall furnish, supply and provide, as may be necessary without specific direction of the Engineer, all fuels, lubricants, tires and other supplies, all maintenance, repairs and running costs and suitably qualified drivers at all times.

Security

Contractor shall be responsible for the security of the site offices and its contents at all times

First Aid Box

First Aid Box suitably equipped for a site force of about 20 people.

The foregoing furniture, equipment and miscellaneous items shall be provided and installed by the CONTRACTOR within 15 days of the Letter of Intent from the EMPLOYER.

Sanitary Accommodation for Site

The CONTRACTOR shall also maintain and service a suitable sanitary accommodation facility and provide consumable stores including soap, etc.

Surveying Equipment

The CONTRACTOR shall provide & maintain in an accurate and serviceable condition the following new surveying equipment at Site at all times during the execution of the WORK:

- 1No. Theodolite to read to 20 seconds complete with tripod and accessories.
- 1No. Reversible level complete with tripod and accessories.
- 1No. 14 ft. telescopic leveling staff graduated in feet.
- 1No. 100 ft. steel tapes.
- 1No. 50 ft. steel tapes.
- 1No. 12 Ft. flexible steel tapes.
- 1No. Steel tape repair kit.
- 1No. Plumb bobs.

The foregoing equipment shall be inspected at the Site of WORK by the EMPLOYER'S REPRESENTATIVE within 15 days of the receipt by the CONTRACTOR of the Letter of Intent from the EMPLOYER.

In addition to the specified list of equipment, the CONTRACTOR shall also provide and renew from time to time such miscellaneous materials and equipment as might reasonably be required at the Site.

Traffic Routes to be Maintained

The CONTRACTOR shall not cause unnecessary obstruction of roads, footpaths or waterway at any time during the course of the WORK and in no circumstances shall closure, in whole or in part, of these or any other "right of way" be permitted except with the prior permission of the EMPLOYER'S REPRESENTATIVE in writing. All disturbances to be negotiated with the affected community in advance.

The CONTRACTOR shall maintain adequate, through safe traffic routes for vehicles and pedestrians on public highways within and adjacent to the Site of the WORK, including such diversions of highways as may be required, and make arrangement for watching, signaling, and control of traffic by day and night and for adequate lighting all to the satisfaction of the EMPLOYER'S REPRESENTATIVE.

All temporary diversions shall be constructed to adequate widths and maintained in good condition at all time by the CONTRACTOR to the satisfaction of the EMPLOYER'S REPRESENTATIVE and on completion of the CONTRACT all such road shall be left in a condition approved by the EMPLOYER. The temporary diversions shall be removed and reinstated to the satisfaction of the EMPLOYER/EMPLOYER when no longer required.

The CONTRACTOR shall make arrangements and co- operate with all other CONTRACTORS working in the area for directing, routing, marshalling, controlling and circulating the traffic connected with the WORK in accordance with the EMPLOYER'S REPRESENTATIVE requiremen in order that the flow of all traffic may be facilitated, that all obstruction, inconvenience & delay may be minimized and that the interest of all concerned including the general public may be promoted.

The CONTRACTOR shall, before commencing work affect any public highway or right of way, submit to the EMPLOYER'S REPRESENTATIVE his proposals for the control of traffic, access for residents & diversions in respect of the area in which he proposes to work. The EMPLOYER'S REPRESENTATIVE will instruct the CONTRACTOR to make such amendments as are considered necessary.

The CONTRACTOR shall pay all cost and expenses attendant upon the employment of any Police, which the Local Magistrate/Government may appoint for the preservation of peace, or the prevention of trespass and theft, or for any other purpose on or near the site of the WORK.

Protection of Livestock

The CONTRACTOR shall be responsible for protection of livestock against damage or accidents because of the WORK, during day and night. All gaps made in fences and hedges etc. to be closed when WORK are not in progress and all trenches and excavations to be suitably protected.

Haulage Routes

The CONTRACTOR shall submit to the EMPLOYER'S REPRESENTATIVE as soon as possible after the acceptance of the Tender and from time to time thereafter as required, proposals for the routing of traffic in connection with the execution of WORK being the traffic of the CONTRACTOR, his suppliers in the movement or haulage of heavy loads, construction plant, materials and spoil (hereinafter referred to as "the construction traffic") including particulars of the public roads of the public roads which he, the CONTRACTOR, proposes to select as routes to be used by the construction traffic.

The EMPLOYER'S comment on all such proposal as may be submitted by the CONTRACTOR.

Support

The CONTRACTOR shall provide ample shoring to all poles, buildings, walls, roads, railings and structures etc., adjacent to the trenches and shall carry out the trench work in close-timbered lengths near such property at his own expense.

Protection Mains, Services & Apparatus

The information given on the Drawings relating to existing services is given for general guidance only and is not guaranteed and no responsibility & Apparatus whatsoever is accepted by the EMPLOYER for the accuracy thereof. The CONTRACTOR shall refer directly to the concerned authorities for more detailed information on any of the services within the working spaces of the site.

The CONTRACTOR shall not cause or permit interference with mains, services or apparatus whether indicated on the Drawings or not & shall be responsible for their protection. He shall give notice and provide reasonable facilities to the relevant authority and/or their servants to enable them to do alterations, repairs or maintenance WORK if so required.

If during the course of the WORK underground services are uncovered they shall be carefully protected and shall be immediately referred to the EMPLOYER'S REPRESENTATIVE.

Diversion of Mains, Services & Apparatus

The CONTRACTOR shall make arrangements with the appropriate owners/ authorities and pay all costs for any temporary diversions of mains, services and apparatus which may be required in carrying out the WORK.

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 water-courses. Wherever necessary to prevent this, the CONTRACTOR shall construct temporary drainage channels, layers, sumps and traps in addition to those shown on the Drawings discharging into existing drains, ditches or water-courses. The CONTRACTOR shall remove 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 WORK including those below subsoil 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 WORK therein and for the collection and disposal of water shall be to the EMPLOYER'S approval. All costs and charges in dealing with water in anyway whatsoever and effects thereof will be deemed to be included in the several rates in the Bills of Quantities.

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 sumps shall generally be clear of the WORK unless approved otherwise by the EMPLOYER'S REPRESENTATIVE.

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 WORK in any other way.

Notwithstanding the approval by the EMPLOYER'S REPRESENTATIVE 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.

WORK to be Water-tight

All WORK, intended to retain or exclude water or through which water is to be passed shall be absolute water-tight, so as not only entirely to prevent loss of water from the WORK, but also so as entirely to prevent the percolation of water into any part or parts of the WORK.

Name Boards / Temporary Signage

The CONTRACTOR shall erect only such name boards as the EMPLOYER may approve. These must be of simple and becoming appearance. They shall display the name of the project, the CONTRACTOR, and such other information as the EMPLOYER may direct or approve.

Materials at Site

Payment for unfixed materials delivered on site shall be included in the Monthly valuations shall and shall be certified as provided for by the Conditions of Contract.

The valuation so certified by the Engineer shall be the invoiced cost of the materials, if the Engineer considers this cost to be realistic, plus any customs duty or other taxes paid together with an allowance for port dues and delivery to and unloading at the Site. The valuation for unfixed materials on site shall be the net reimbursement to the Contractor of the cost of the materials delivered and unloaded at the Site and as such shall be exclusive of any profit or Contractor's overheads mark-up.

Notwithstanding the foregoing, such net reimbursement to the Contractor for unfixed materials on Site shall be less than the total price included by the Contractor in the Bill of Quantities for both supplying fixing and sufficient value shall be retained for payment to the Contractor in subsequent monthly payment for permanently fixing the materials in the Works.

The Contractor shall make due allowance in pricing the Bill of Quantities to take account of these clauses.

Formwork materials including all struts, timber or sheet boarding, all other timber work, waffle moulds, proprietary shuttering and the like shall not be considered as "unfixed materials on site" for the purposes of monthly valuations.

Shop Drawings, Working Drawings, Operations and Maintenance Instructions.

The Contractor is to allow in his rates for the production of all shop drawings, working drawings, operations and maintenance instructions called for in the Specifications.

These shall include but not to be limited to the following:

- (i) The surveyed location of all existing services.
- (ii) A Combined Services Drawing including all surveyed existing and proposed services showing manholes, draw pits, joint boxes, inspection chambers, lighting column bases traffic signal bars, concrete surrounds, pipe diameters, etc. to scale, plus any other possible obstructions.
- (iii) Combined Services Working drawings original and new.
- (iv) Separate sets of working drawings for each individual service showing proposed locations for submission to the service authorities.
- (v) Existing ground levels.
- (vi) Earthworks cross sections.
- (vii) Temporary traffic sign design and fixing details.
- (viii) Proposed traffic sign design and fixing details.
- (ix) Mechanical, electrical and other services drawings, diagrams and instructions as required in the contract and directed by the Engineer.
- (x) Temporary work drawing where requested by the Engineer.

The rates in the appropriate section shall include for design of the civil works as specified in the Contract and for providing working drawings, shop drawings, schedules, specifications, calculations, etc. and for obtaining the Engineer's approval.

Provisional Sums

The Provisional Sums given in the Bill of Quantities may be used in whole or in part, or not at all, on the instruction of the Engineer.

Percentage of adjustment for Provisional Sums as provided in the Conditions of Contract shall not be applicable to any work carried out by other Contractors or Service Authorities employed directly by the Employer. Payments to such Contractors or Service Authorities shall be made directly by the Employer.

The Contractor shall co-ordinate with the Service Authorities and provides all necessary facilities as may be required and as foreseeable by an experienced Contractor. The cost of such co-ordination and facilities is deemed to have been included in the respective item given in Bill No. 1 of the Bill of Quantities.

Bill Item for Conditions of Contract

Payment for this item will be pro-rata to the value of work completed and approved by the Engineer and shall cover all costs and expenses including overhead and profits incurred by the Contractor in carrying out the requirements of the Conditions of Contract, not

otherwise, included in the Bills of Quantities. Breakdown of the same shall be submitted together with the Tender Documents.

Abbreviations

In the Specification and Bill of Quantities the following abbreviations have the meanings hereby assigned to them:

B.S.	Means the specification issued by the British Standards Institution (B.S.I.)
C.P.	Means the code of practice issued by the B.S.I.
AASHTO	means the specification issued by the American of State Highways & Transportation Officials.
ASTM	means the specification issued by the American Society for Testing & Materials.
AC	Asbestos Cement
B.S.	British Standards
Cont'd	Continued
DEPT, Dept.	Department
Dia	diameter
Drg.	Drawing
E.O.	Extra Over
F.C.	Fiber Cement
GRP	Glass Fiber Reinforced Plastics
HDPE	High Density Polyethylene
HP	Horse Power
ISO	International Standards Organization
Kg.	Kilograms
Kw/hr	Kilowatt per hour
L.R.B.	Local Regulatory Body
L.S.	Lump Sum
M	meter
mm	millimeter
m ³ ,cu.m.	Cubic meter
m ² , sq.m.	Square meter
MDPE	Medium Density Polyethylene
Mic	Micron
Min., min	Minimum
MDD	Maximum Dry Density
MH	MANHOLE
No.	Number
Nos.	Numbers
O.P.C.	Ordinary Portland cement
PE	Polyethylene
P.Q.	Provisional Quantity
PVC	Polyvinyl Chloride
Qty.	Quantity
RHS	Rectangular Hollow Section
Spec	Specifications
S.R.C.	Sulphate Resisting Cement
t, tons	tonne
uPVC	Unplasticised Polyvinyl Chloride
W	Width
P.C. Rate	prime cost rate
>	Greater than
≥	Equal to or Greater than
<	Less than
≤	Equal to or Less than
=	Equal to

Rates for various items throughout the Bills of Quantities shall include, unless otherwise stated or measured, for cutting of every description and the consequent waste, for work in girths, widths or heights of less than 300mm and for all short lengths.

Rates for all work shall include for protection, provision of samples and testing.

The pricing of materials shall take account of the following:

- (i) Pricing Preambles and Specifications shall apply reciprocally between sections of the works unless otherwise described.
- (ii) Materials shall be of the quantity specified unless otherwise directed by the Engineer.
- (iii) All materials shall be transported, handled, stored and fixed in accordance with the printed instructions or recommendations of their manufacturer's or suppliers.
- (iv) Protection of completed work, all casings and temporary coverings and making good, cleaning and polishing and clearing away upon completion.

Variations

The rates inserted in the Bills of Quantities with application of adjustment item will be used to value any variations to the work, whether omission or addition. The Contractor shall not be entitled to payment for profit and overheads on the value of work omitted.

Any claim or additional General Requirement costs, General and Special attendance's, Builders work and the like on variation Works, shall be considered only upon receipt of full supporting contemporary substantiation being presented by the Contractor to the Engineer.

Fix only

The expressions "fix only" used in these Bills of Quantities means that the contractor shall provide the following facilities:

- (i) Fixing as defined in Clause GP 7.2 of POM(I).
- (ii) Supplying full size templates.
- (iii) Giving and marking dimensions and taking responsibility for their accuracy.
- (iv) Getting in, protecting, handling, distribution and placing in position.
- (v) Assembling as required.
- (vi) Casing up and protection, including clearing away protection on completion of the works.
- (vii) Full cost of replacement of any items which are damaged, broken, lost or stolen after the acceptance of the items from the supplier or client and until handing over the complete works.
- (viii) Other necessary and usual facilities and documentation.

Supply Only

The expression "supply only" used in these Bills of Quantities means that the Contractor is to provide for everything as defined in Clause GP4.1 of POM(I) in connection with such items except fixing in position. All such items are to be delivered to Site and stored in accordance with the Engineer's instructions.

Sub-Contractors

Any sub-contractors which the Contractor proposes to use for the works are subject to the approval of the Engineer and the Employer.

The Contractor should ascertain from sub-contractors and suppliers before the works put in hand particulars of positions in which chases, holes, mortices and the like will be required to be formed or left. No claim for the extra costs of cutting away work already built due to the Contractor's failure to ascertain these particulars will be admitted.

Any sub-contractor who has not been approved by the Engineer and the Employer shall not be used in connection with the carrying out of the Works.

The Contractor shall allow for any additional costs incurred due to sub-contractors working different hours from and extended hours to those worked by the Contractor.

Prime Cost Rates (PC Rates)

Where Prime Cost (PC) Rates are included, the Contractor is to include in his rate the full amount shown. Such rate is for the material cost only of the particular item so described, delivered to the site. The Contractor is, in addition to those relevant items listed at Clause A, Page 9, to allow in his rates for all auxiliary materials required for fixing such as mortar for bedding and jointing, adhesive and all similar items of a like nature. The Prime Cost will be expended at the discretion of the Engineer and the adjustment to the Contractor's rate will be the net difference between the Prime Cost (PC) Rate stated in the description and the actual price paid (benefit of any discount passing to Employer).

The word "attendance" means the following:

Attendance to be provided by the Main Contractor

The Main Contractor shall be responsible for providing, including but not limited to, the following attendances:

- i) Use of Main Contractors administrative arrangements.
- ii) Use of Constructional Plant.
- iii) Use of Contractor's Mess Room, Sanitary and Welfare Facilities.
- iv) Co-ordination and scheduling of all works related to each sub-contract.
- v) Use of Standing Scaffolding.
- vi) Use of Temporary Works including water and Electricity.
- vii) Supplying full size setting out templates.
- viii) Giving and marking dimensions and taking responsibility for their accuracy.
- ix) Space for Sub-Contractors Office and Stores.
- x) Providing working space.
- xi) Offloading Sub-Contractors materials and placing in Stores.
- xii) Clearing away rubbish.
- xiii) Other necessary and usual facilities, documentation, general intergrades attendances, labor and assistance.

Attendance to be provided by the Sub-Contractor shall include but not be limited to the following

- i) All special scaffolding required by him in the execution of his works.

- ii) Taking from stores, distributing, hoisting and placing in position, all items of plant, equipment and materials required by him in the execution of his works.
- iii) All labor, plant, etc. (other than included in Attendances to be provided by Main Contractor).
- iv) Site offices and stores required by him for the execution of his works.
- v) Obtaining security passes for access of work people to the Site.

Site Work

All quantities for excavations have been measured net with no allowance for increase in bulk or working space.

The method of measurement and any measurement will be entirely at the discretion of the Engineer but generally will be as follows:

- (i) Where there is no reduced level excavation, other excavations will be measured from natural ground level.
- (ii) In instance where there is excavation to reduce levels, other excavations will be measured from the reduced level.

Should the Contractor be able to use any excavated material arising from the works as general filling then it shall be measured as material backfilling in making up levels with a deduction of items for filling and for material removed from Site.

In addition to the provisions of POM (I) Sections B8 rates for excavation shall include for the following -

- (i) Excavation by whatever means are necessary including hand excavation in any kind of ground material including running silt and running sand.
- (ii) Excavation to the Commencing Level to be measured separately.
- (iii) Commencing excavation at any depth.
- (iv) Excavation below the normal water table level.
- (v) Over break and soft spots including filling with mass concrete to the levels required by the Engineer.
- (vi) Forming temporary spoil heaps where required and multiple handling including any charges in connection therewith.
- (vii) Working space.
- (viii) Excavation around existing services and mains.
- (ix) Trimming or grading ground to produce level surfaces or surfaces to falls or slopes.
- (x) Ramming and compacting sides and bottom of excavations.
- (xi) Supporting the sides of excavations.
- (xii) Keeping excavations free from water by whatever means necessary

The rates for items of imported fillings, graded level filling etc, shall include, but not limited, for the following:

- (i) Grading to slopes and falls.

- (ii) Special compacting to form vertical or battering faces.
- (iii) Forming sinking's.
- (iv) Forming earth bunds and grading to gabions as required.
- (v) Leveling, and compacting to formation levels below roads, buildings, paved areas, etc.
- (vi) Compacting in layers.
- (vii) Any loss in volume due to compaction and for any additional materials required due to penetration of the filling materials into the ground or any settlement or compacting of the original ground levels under the weight of materials or due to methods of compaction or construction traffic.
- (viii) Temporary spoil heaps and multiple handling as required.
- (ix) All labors including handpacking and temporary retaining boards where required.
- (x) Blinding with sand or similar approved fine material where required to receive concrete or the like.
- (xi) (xi) Costs of testing.

Disposal of excess excavated material

Rates for disposal of excess excavated material shall include for any necessary double handling and the provision of a tip, if necessary, including any charges in connection therewith.

Underground Drainage

The rates for trenches for services pipes, drainage pipes, ducts, cables, etc. shall include for disposal and for bedding and backfilling as specified for each service.

The rate for trenches shall include for backfilling to trenches with approved excavated material. If the excavated material is not suitable imported fill shall be used.

The rates for drains, inspection chambers, etc. are to allow for testing.

Rates for drain pipes generally are to include for all short lengths, back stops, wooden plugs and retaining and alignment pegs required in laying and for the extra involved over normal trench excavating in hand packing and tamping selected fine material around the lower half of the pipes to buttress them against the side of the trench. Rates are to be include for leaving all pipes clean and clear.

Pipes are measured nett as laid and are to include for all cuttings, etc. for laying in trenches of any depth, and building in to sides of inspection chambers.

Rates for drain fittings on all types of drain pipes are to include for extra joints of all types and cutting and waste on all pipes.

Rates for drain accessories shall include for concrete surrounds and any additional excavation and disposal.

The rates for all concrete work shall include for the following:

- (i) Concrete testing and testing cost.
- (ii) All considerations arising from the specification.
- (iii) Mixing, hoisting to any height or lowering to any depth and placing and compacting on the surfaces of any material or on formwork by whatever means necessary.
- (iv) Pouring in hot weather conditions in accordance with the Specification.

- (v) Compacting by vibrators if required.
- (vi) Forming any control and construction joints, locations as agreed by the Engineer.
- (vii) Shuttering to upper surfaces not exceeding 15 degrees from horizontal.
- (viii) Curing, hacking surfaces for key and protecting concrete surfaces from harmful weather conditions.
- (ix) All surface treatment to unset concrete.
- (x) Finishing to floor slabs as Specification.
- (xi) Expanded metal lathing and angle beads.
- (xii) Joint sealing between concrete and plaster.
- (xiii) All costs in connection with the construction of "kickers".
- (xiv) Forming and grouting grooves and mortises and making good to holes and mortises.
- (xv) Water bars and the like.

The rates for plain concrete foundations and concrete blinding shall include for the following:

- (i) Any extra volume of concrete used in lieu of formwork.
- (ii) Forming sloping surfaces where required.

The rates for concrete work laid in trenches as bed or surround to all pipes and ducts shall include for all necessary formwork.

The rates for reinforced concrete shall include for working concrete around reinforcement.

The rates for bar reinforcement shall include for the following:

- (i) Extra material in hooks, laps and the like not required by the Specification.
- (ii) Positioning and protecting starter bars.
- (iii) Straightening (if required) cutting to length and bending reinforcement to required shapes and complying with the Specification.
- (iv) Fixing rods of any diameter in any position including any necessary hoisting.
- (v) All considerations arising from the Specification.
- (vi) Epoxy coating as required and all necessary preparation.
- (vii) Supporting in position during concreting, provision of supports, chairs, block spacers and steel binding wire and approved / proprietary distance pieces.
- (viii) Welding bars to form mesh reinforcement.
- (ix) Additional cutting and bonding in connection with holes, mortises, pockets, grooves, chases and the like.
- (x) Providing bar bending schedules to be checked and approved by the Engineer.

The rates for fabric reinforcement shall include for the following:

- (i) Straight, raking, curved and circular cutting and waste.
- (ii) Bending to profiles.
- (iii) Laps of once full square / rectangular module or as noted.
- (iv) All considerations arising from the Specification.
- (v) Supporting in position during concreting; provision of supports, chairs, block spacers, steel binding wire and approved / proprietary distance pieces.

- (vi) Cutting, bending and notching around all obstructions.

Formwork

The rates for formwork or moulds shall include for the following:

- (i) Small quantities.
- (ii) All cutting and waste including raking curved or circular cutting and notching around pipes, ducting and fittings.
- (iii) Grooves of any sectional areas, all stops, chamfers and splayed angles.
- (iv) Setting up, strutting and supporting at any height above the structure subject to any limitations imposed by the Engineer.
- (v) All considerations arising from the specification.
- (vi) Carefully coating with mould oil ensuring that no shutter oil is applied to surfaces of reinforcement.
- (vii) Easing, striking, removing and cleaning and preparing for re-use and removal when no longer required.
- (viii) The provision of all props, stays, struts, wedges and bolts.
- (ix) Overlaps and passing's at angles and labors at intersections.
- (x) Shortening struts or shapes and re-strutting or reshoring where required.
- (xi) Rubbing down, filling and making good the surface of concrete after removal of shuttering.
- (xii) Cutting or notching shutters or moulds to in-situ or precast concrete around projecting reinforcement.

The rates for wrought formwork to produce a special finish shall include for the following:

- (i) Any necessary rubbing down or filling allowed by the Specification to produce the finish demanded by the specification.
- (ii) Cutting out and re-casting unsatisfactory work or work not fulfilling the requirements of the specification.
- (iii) Carrying out remedial or any other work required by the Engineer as an alternative to cutting out substandard work.
- (iv) All consideration arising from the specification.

Precast Concrete

The rates for precast concrete shall include for the following:

- (i) Reinforcement.
- (ii) The provision of moulds.
- (iii) Forming a fair face in accordance with the specification to all exposed surfaces.
- (iv) Square, rounded and mitred angles.
- (v) Hacking or forming keys to all other surfaces.
- (vi) Holes or notching for pipes.
- (vii) All considerations arising from the specification.
- (viii) Hoisting to any height including the provision of lifting hooks or other devices approved by the Engineer.

- (ix) Setting and bedding in position and jointing in mortar as specified.
- (x) All necessary temporary struts or supports.
- (xi) Sills and copings etc. shall include for plain ends and mitred angles where necessary.

Reinforcement to Masonry

- A. The contents of this section equally apply to reinforcement included within the Masonry section of the Bills of Quantities, unless otherwise stated.

Masonry

The rates for blockwork shall include for the following:

- (i) Block testing at a recognized laboratory, provision of certificates.
- (ii) All considerations arising from the specification.
- (iii) Building at any level or height of slabs or beams.
- (iv) Small quantities and any extra labor in forming kerbs.
- (v) Straight, raking, curved and circular rough or fair cutting.
- (vi) Forming bull nose edges to quoins and the like.
- (vii) All labor and materials necessary for closing wall cavities.
- (viii) Plumbing at angles.
- (ix) Cutting and bonding at angles, openings and intersections.
- (x) Building into and / or against adjacent work.
- (xi) Providing solid course blockwork at still level at all openings and bearings of all in-situ concrete and at the top of all free standing walls.
- (xii) Wedging and pinning up to soffits and all insulation required between tops of concrete block partitions and underside of structure.
- (xiii) Special or concrete filled blocks at angles, openings and intersections, and soffit junction and heads of walls.
- (xiv) Providing any means necessary to prevent concrete cast on hollow blockwork or over cavities from falling into voids or cavities (subject to the approval of the Engineer).
- (xv) All necessary keys for in-situ finishing.
- (xvi) Grouting up at back of walls built against other construction.
- (xvii) All necessary starter bars and cast in wall ties at junctions between blockwork and in-situ concrete and all strap supports and lateral supports in accordance with the Specification and shown on the drawings.
- (xviii) All reinforcement to blockwork in accordance with the Specification and shown on the drawings.
- (xix) All necessary expansion joints, control joints, sealant and termination bars as required by the Specification and shown on the drawings.
- (xx) Fire stopping and smoke seals.
- (xxi) Insulation.

The rates for block walls shall include, for the following additional labors:

- (i) Cutting or forming chases or grooves for slabs, partitions, staircases, etc.
- (ii) Cutting grooves for water bars, flashings and the like and making good and pointing in similar mortar.

- (iii) Bedding and pointing frames, etc., building in door and window frames and the like.
- (iv) Building in or cutting and pinning in and making good ends of lintels, brackets, timbers, steelwork, holder bats and the like.
- (v) Building in or cutting for and making good around pipes, ducting, fittings and the like.

Metal Work

The rates for all steelwork and metalwork shall include for the following:

- (i) Ends, angles, intersection, ramps on frames, bearers, stays and the like.
- (ii) Assembling and jointing together components.
- (iii) Stanchions and rafter restraints, gussets and end places.
- (iv) Allowance for rolling margin.
- (v) The weight of weld metal in welded constructions.
- (vi) Members of any length.
- (vii) Cutting to size and shape and joints in the running length.
- (viii) Notches, holes, slots, miter / angle ends, and for all drilling and splay cut ends.
- (ix) Grinding welds to a smooth finish, unless otherwise required.
- (x) Fixing with appropriate non-corroding countersunk screws including holes unless otherwise described.
- (xi) Riveted and bolted work shall include rivets, bolts and holes and countersunk holes.
- (xii) Approved protection to cut ends or holes in galvanized work or other applied finish.
- (xiii) All considerations arising from the specification.
- (xiv) Metal door frames shall include for assembling, fixing with clamps, filling with mortar, temporary supports and removal of base ties.
- (xv) Floor plates, duct covers and the like shall include narrow widths, laying in position, frames, and for all holes, slots and the like and making good.
- (xvi) All preparation, protection coatings and final decoration with the items to which they relate.
- (xvii) All fittings and fixing required, including grouting in position.
- (xviii) Forming cambers in structural steel beams as indicated on the drawings.
- (xix) Shop drawings.

"Welding" is deemed to be in accordance with the specification and for the material to which it is to be used. Base plates, ends, caps, cleats, brackets, stiffeners, bolts, etc., shall be included in the weights of the associated steelwork in which they occur.

Woodwork

Sizes of sawn timber are basic.

Sizes of milled (wrote) timbers are finished.

Woodwork shall be deemed to be fixed with non-corroding nails unless otherwise described.

Screwed woodwork shall be described and shall be deemed to be fixed with non-corroding screws.

These preambles apply equally to all items measured as composite units.

The rates for woodwork shall include for the following:

- (i) Working to size and shape.
- (ii) Raking, curved or splay cutting.
- (iii) Short lengths, mitres, stops, ends and angles.
- (iv) Rebates, chamfers, grooves, scribed edges, rounded edges and the like.
- (vi) Cross grain and stopped work.
- (vii) All joints in the running length including structural joints.
- (viii) Cutting and fitting to steelwork.
- (ix) All considerations arising from the specification.
- (x) Trimming around openings.
- (xi) Extra timber in joints, horns, etc.
- (xii) Notching, boring and sinking have, rounded curves and splayed edges.
- (xiii) Holes for pipes, tubes, bars, cables, conduits, ducting, trunking and the like.
- (xiv) Treating backs of woodwork in contact with structure.

The rates for framed woodwork shall include for the following:

- (i) Proper framed joints.
- (ii) Glueing joints.
- (iii) Doweling cramps and / or screwing joints.

The rates for milled woodwork shall include for the following:

- (i) Punching, fixings below exposed surfaces and filling flush.
- (ii) Any necessary sanding to remove "rippling" caused by milling machines.
- (iii) Wreaths, ramps and the like.

The rates for wood work described as "selected" shall include for the following:

- (i) Keeping clean and clear finishes.
- (ii) Punching nails and pins below exposed surfaces and filling with an approved colored filler to match the woodwork.
- (iii) Where described also as "screwed" the woodwork shall be fixed with screws recessed and pelleted to match the woodwork.

The rates for doors shall include for fitting and hanging any type.

The rates for frames and linings shall include for bedding in specified mortar where required.

The rates for plywood, blackboard and the like shall include for straight raking curved and circular cutting and all consequent wastage.

The rates for plastic laminate faced manufactured boards shall include for providing plastic laminate edgings and balancing laminates and removal of protective coatings.

The rates for ironmongery shall include for the following:

- (i) Mortises, sinking's and the like.
- (ii) All considerations arising from the specifications.

- (iii) Removing before and replacing after decoration.
- (iv) Fixing to wood or metal doors.
- (v) Testing and easing and adjusting.
- (vi) Oiling and leaving in perfect working order.
- (vii) Adhering strictly to mastering and sub-mastering schemes.
- (viii) Supplying and labeling at least two keys for each and every lock and handing over to the Engineer.
- (ix) Master key if required by the specification or drawings.

The rates for ironmongery described as "fixed to hardwood" shall include for fixing to plywood, blackboard and the like.

Thermal and Moisture Protection

The rates for work in this section shall include for the following:

- (i) Preparation and priming of surfaces to receive membranes.
- (ii) Laps, seams and narrow widths.
- (iii) Straight, raking, curved and circular cutting, notching, bending and all consequent wastage.
- (iv) All considerations arising from this specification.
- (v) Cement sand triangular fillet to returns behind the waterproofing membrane.
- (vi) Holes for pipes, standards and the like.
- (vii) Angles, returned ends and dressed ends on flashings.
- (viii) Dressing up and cover up stands and around and into gargoyles, vent pipes and the like.
- (ix) Tropical grade mastic pointing to all flashings.
- (x) Forming outlets, skirting, aprons, gutters and channels and forming small openings.
- (xi) Flashings and the like to penetrations through waterproofing systems.
- (xii) Clearing rubbish and cleaning areas on completion.
- (xiii) Testing in accordance with the specification and to the approval of the Engineer.
- (xiv) Providing an appropriate warranty / guarantee as required by the specification.
- (xv) Cement sand cant and reinforcing strip at corners.

Applied finishes described in this section are deemed to be measured as the relevant preamble in which they occur.

The cost of the mastic sealant and backer rod to be included in the item for Aluminum flashing.

Doors and Windows

The rates for work in this section shall include for the following:

- (i) Frames.
- (ii) Sub-frames.
- (iii) Architraves.
- (iv) Transoms.

- (v) Stops.
- (vi) Sealant.
- (vii) Weather bars.
- (viii) Thresholds or sills.
- (ix) Glazing.
- (x) Insulation.
- (xi) Ironmongery (except in timber doors where it is measured separately).
- (xii) Decoration.

Sizes referred to are structural opening sizes.

Ironmongery

Matching screens, keys and framing mortises in glass and the like shall be understood to be included.

Finishes

All finishing, screeds and backings have been measured net.

Rates for finishes shall include for the following:

- (i) Well wetting solid surfaces to be plastered or screeded.
- (ii) Preparing surfaces for finishing on backings including raking out joints of blockwork partitions, hacking surfaces of concrete or applying bonding agent to form a key and any necessary dubbing out.
- (iii) All cutting and waste, arises, short lengths, angles, ends, etc., making good or cutting and fitting around pipes conduits trunking pipe brackets and the like and making good up to door and window frames, skirting etc., all temporary rules and working around buried pipes, cables, conduits, etc.
- (iv) Angle beads, plaster stops, control joints, expanded metal strips, furring and lath, glass fibre scrims, aluminum channels and the like to all plasterwork around doors, windows at vertical abutments etc., and securely fixing to backgrounds.
- (v) All narrow widths, small areas and all cuttings.
- (vi) Fair edges, rebated edged, splayed edges, rounded edges, arises, quirks, grooves, flutes and the like.
- (vii) All setting out, temporary rules, screeds, templates and supports.
- (viii) Curing and cleaning off / down upon completion.
- (ix) Dubbing out as necessary to take up tolerances in the structure and cambers in floors and the like.
- (x) Expansion joints and control joints.
- (xi) Expanded metal lathing wherever required.

Rates for screeds and backgrounds shall include for the following:

- (i) Finishing with a tampered floated or trowelled surface as required.
- (ii) Laying level or to falls or slopes as required.

- (iii) Laying in bays where required including formwork to all edges, reinforcement, joint filler and sealant as detailed and specified.

Rates for wall and floor tiles and the like shall include for the following:

- (i) Fixing with an approved adhesive.
- (ii) Pointing up joints with mortar and cleaning off as required.
- (iii) Rounded, beveled and fair edges as required.
- (iv) Metal edge strips, dividers etc.
- (v) Straight, raking and curved cutting.
- (vi) Provision of expansion joints and sealant as indicated on the drawings.
- (vii) Provision of slurry protections or the like including removing same in floor areas subjected to movement of labor and materials.
- (viii) General protection of finished work to the Engineer's approval.

Rates for ceiling finishes shall include for the following:

- (i) Finishing with trowelled surface or other as required.
- (ii) False ceiling to include for all hangers, ceiling grid, tiles and insulation layers, and drop of any height.
- (iii) Bulkheads as shown on drawings.
- (iv) Work to sloping, curved, level soffits as required.
- (v) Straight, raking and curved cutting.
- (vi) Cutting and fitting around light fittings, A/C. equipment, etc.
- (vii) Shop drawings.
- (viii) Supporting framework, angle trims and other accessories.
- (ix) Lining to ceilings, beams and up stands.
- (x) Metal plaster stops, angle beads, etc.

Painting and Decoration

Painting to Structural Steelwork and Metalwork may either be included in this section or within either section to which it occurs and has been measured either as M2 or kg of Steel/Metalwork.

The rates for painting and decorating shall include for the following:

- (i) Painting either internally or externally.
- (ii) All cleaning and preparatory work to the surface to be painted including rubbing down between coats.
- (iii) Priming shall include for using a primer appropriate to the surface to which it is being applied.
- (iv) Preparation of manufactured boards and wood products shall include for surface filling.
- (v) Work on "Woodwork" shall include both softwood and hardwood and for knotting.
- (vi) Extra preparation on metal trims and the like over that of general surfaces in which they are decorated.
- (vii) Unless of a differing specification, work shall be deemed to cover internal or external painting.

- (viii) Work in multi-colors.
- (ix) Work to curved surfaces.
- (x) All cutting into edges.
- (xi) Scaffolding as required and working to or at any height.
- (xii) All narrow widths, cutting to line, opening edges of doors.
- (xiii) Rates for sprayed paint shall include for all masking work.

Mechanical Installations

The rates and prices for plant, equipment and installations are to be all inclusive of supply, installation, testing, commissioning and all associated builders work required for the full operation of such plant, equipment and installations, to comply in all respects with the Specification, Bills of Quantities, Drawings and to the complete satisfaction of the Local Regulatory Body and the Engineer.

The rates for pipework and ductwork shall include for the following:

- (i) All cuttings, short lengths and small quantities.
- (ii) Made bends.
- (iii) Couplers and / or joins in the running length.
- (iv) Splay cut ends.
- (v) All considerations arising from the specification.
- (vi) Fixing with approved holder bats or pipe clips cut and pinned, built in or plugged and screwed.
- (vii) Sleeves through walls.
- (viii) Bends and fittings on pipes whatever the diameter.
- (ix) Fittings to ductwork of all shapes and sizes.
- (x) Rates for cable and duct trench excavation shall include for all excavation, bedding, backfill and disposal as required by the Statutory Authority standard specification.
- (xi) Backfilling to trenches with approved excavated material. If the excavated material is not suitable imported fill shall be used.

The rates for sanitary fittings and the like shall, unless otherwise described or implied, include for the following:

- (i) Assembling component parts including suitable bedding compounds.
- (ii) Flexible connections from the supply point.
- (iii) All necessary plugging and screwing.
- (iv) Joints to water services with straight or bent proprietary connectors.
- (v) Cleaning off all protective wrappers and leaving ready for use.
- (vi) Leaving taps and valves greased, clean and in full working order.

The Contractor shall include for the supply of manufacturers recommended spares as required by the Specification for all mechanical engineering installations and shall submit details of spares to be provided by him on the Schedule of Recommended Spares, including other relevant details.

Rates for Plumbing and HVAC Work

Rates for all pipe work shall include for assembling and joining, pipe supports, pipe sleeves and cover plates and the like.

Rates for pipework shall include for all fittings to small pipes (i.e. pipes into an internal dia. of 60mm or less) fittings (except joint in running lengths) to large pipes (i.e. pipes with internal dia exceeding 60mm) and to gutters shall be enumerated, grouped together for each size of pipe and gutter and described as fittings.

Rates for duct work are to be included all fittings, brackets, hangers and other support.

Rates for insulation are to be included for cutting, waste, joining lap and working around and our ancillaries, fittings, flanges and other obstructions.

Electrical Installations

The rates and prices for plant, equipment and installations are to be all inclusive of supply, installation, testing, commissioning and all associated builders work required for the full operation of such plant, equipment and installations, to comply in all respects with the Specification, Bills of Quantities, Drawings and to the complete satisfaction of the Local Regulatory Body and the Engineer.

The rates in general shall include for the following:

- (i) All cutting, short lengths and small quantities.
- (ii) All joints in the running length and all connections.
- (iii) All considerations arising from the specification.
- (iv) Fixing conduits / cable trays, etc., by approved methods.
- (v) Pipe sleeves through walls.
- (vi) Assembling component parts.
- (vii) Cleaning off all protective wrappers and leaving ready for use.
- (viii) Leaving all equipment etc., clean and in full working order.
- (ix) Draw wires in empty conduits.
- (x) Rates for cable and duct trench excavation shall include for all excavation, bedding, backfill and disposal as required by the Statutory Authority standard specification.
- (xi) Backfilling to trenches with approved excavated material. If the excavated material is not suitable imported fill shall be used.

The Contractor shall include for the supply of manufacturers recommended spares as required by the Specification for all electrical engineering installations and shall submit details of spares to be provided by him on the Schedule of Recommended Spares, including other relevant details.

The cable lengths / routes are measured from point to point on the drawing (horizontal plan distance on the drawing, any cable required for connections, loops, etc., at equipments, appliances, control gear or the like will be deemed to be included.

Multiple Ducts and Cables

The quantity stated in the Bills of Quantities for multiple ducts and cables is the length of a single duct or cable in the particular group of ducts or cables. The contractor will allow the cost of number of ducts or cables in the rate as appropriate. eg., a qty of 50m against a 3 way

200mm dia duct means that a total quantity of $50 \times 3 = 150\text{m}$ of 200mm duct is to be priced for, ditto for cables.

External Services

The rates for all manholes and the like are to be all inclusive of all costs for the complete construction, in accordance with the specifications, drawings and local authority requirements.

External Works

Where external works are analogous to other sections of the work e.g. excavation concrete etc., the clauses elsewhere shall apply equally to this section of the work.

Kerbing – Rates shall include for construction of concrete bed and lacking, supply and laying of precast concrete kerbs either straight or curved, finishing, curing and protecting building in gratings and frame.

Paved areas (footpaths and roadways) – Rates shall include bedding material, supply and laying of paving slabs including all cutting to fit around manhole covers and the like. Allow for forming patterns and designs in the paving stones all as detailed.

The rates for gates and fences in this section shall include for the following:

- (i) Frames including lugs.
- (ii) Sealant.
- (iii) Ironmongery.
- (iv) Decoration.
- (v) Civil works including earthworks, concrete, formwork, reinforcement, protections, etc.

Proprietary Materials

Where manufacturers names or proprietary material names are given against certain items in the Bills of Quantities, the rates and prices inserted shall be for those specified material or other similar and equally approved materials. All proprietary materials shall be installed strictly in accordance with the manufacturer's printed instructions and the Contractor shall be deemed to have allowed for such in his pricing.

Measurable Contract

This Contract is a Measurable type of Contract.

Builder's Work

Drilling, cutting or leaving of holes for pipes, ducts and the like through walls floors, partitions, roofs, etc., and subsequently making good.

Cutting and pinning ends of supports for pipes, equipment, appliances, fittings and the like to walls, floors, partitions, soffits, etc., and making good.

Cutting or leaving mortises, sinking's, etc. for holding down bolts, brackets, supports and the like and grouting in.

Cutting chases for pipes and the like in walls, floors, partitions, etc. and subsequent making good.

Cutting and fitting around, boring holes through and making good of finishing's up to pipes, supports, brackets and the like.

The formation of concrete bases, plinths, etc. for plant, tanks, and equipment, including anti-vibration pads incorporated within the plinth as necessary. The subcontractor shall supply all other vibration isolation.

The painting of exposed pipe work, fittings, equipment etc.

The supply and installation of sub-frames where required for grilles, diffusers, luminaries, sprinkler heads, loudspeakers and the like.

Cutting and making good openings in false ceilings, bulkheads, walls for grilles, diffusers, luminaries, sprinkler heads, loudspeakers and the like.

The Contractor shall be completely responsible for obtaining the requirements for holes, fixings, and any other builders work between trades and ensure that such information as is shown on the drawings is in accordance with his own and the Employer's requirements. Details of builders work which is not shown in the drawings but which are required by the Contractor / Subcontractors shall be forwarded to the Engineer for his written approval before the work is put in hand. Cost of such works shall be borne entirely by the Contractor.

the drilling, cutting or leaving of holes or aperture through structural floors, walls, beams etc., shall be avoided, but where this become a necessity the Contractor must obtain the written approval of the Engineer before such work is put in hand. Cost of such works shall be borne entirely by the Contractor.

Installation of all embeds to be cast to the concrete such as brackets, channels, bolts or plates required for fixing of cladding and curtain walling. Embeds to be provided by the subcontractor.

Coordination and provision of all necessary holes in the steel structure for fixing of cladding.

"Builders work" will include all the above, but it should be noted that this list is not intended to be exhaustive and everything necessary will be deemed to be included.

The Contractor is referred to the Architectural/Structural Drawings for further information. The Contractor shall allow for any plinths or bases required for MEP equipment installations.

"Builders work" shall include for all penetrations through concrete surfaces for MEP Equipment, including (but not limited to) stair pressurization fans, ventilation openings through skylight up stands, fire barrier seals as required and the like.

Items in respect of general attendance (assistance) to be provided by the Main Contractor to the Nominated Sub-Contractors shall include the following items, free of all charges:

Provision of all site hoardings, fencing, controlled access openings and the like.

Provision of temporary hard standings for vehicular traffic and the like.

Provision of un-hindered access to working areas.

Preparation of the site, including (but not limited to); removal of asphalt road surfacing, kerbs, pavers, lighting poles, bollard, shrubs, signage, telephone kiosks and the termination / relocation of all existing underground and exposed services.

Provision of grid lines / markers and levels, including checking and verification.

Use of Contractor's administrative arrangements including the necessary supervision, coordination and shop drawings as applicable / as required.

Opening and maintaining letters of credit, repayments, etc. as applicable/required.

Unloading, distributing, hoisting and lowering of materials.

Unloading the delivered items to site, checking for damage and processing of insurance claims, as applicable / required.

Use of personnel hoist, stairs, platforms and walkways.

Use of constructional plant.

Use of Contractor's facilities.

Use of Temporary Works.

Space for Sub-Contractor's offices and stores.

Scaffolding, including access scaffolding and mobile platform.

Unloading, distributing, hoisting, lowering and placing in position items of plant, machinery or the like.

Provision of water for the Works and that required for testing and commissioning.

Provision of power and lighting for the Works and power required for testing and commissioning, including fuel and consumption charges.

Lifting, hosting, crange etc.

Insurance of the Works.

Provision of safe and secure space for offices goods and materials.

Programming of the Work including progress reporting and co-ordination of the Works to comply with the Contractor's programme.

Co-ordination of the whole of the works including the work of Sub-Contractors and any relevant authorities etc.

Provision of protection to finished work.

Clearance of all rubbish and debris.

Cleaning the finished work as part of the final cleaning obligations as detailed in the Specification.

Provision of any specialist scaffolding, access scaffolding and mobile platforms.

Provision of all specialist lifting, hoisting, crange etc. For off-loading, positioning and installation of materials and services equipment.

Co-ordination of the whole of the Works including the work of other Nominated sub-contractors as Domestic Sub-Contractors and providing all special attendance as required for the works which are required by sub-contractors and not covered under General Attendance's.

Profit

Where the Contractor is required to add for 'Profit' a percentage figure shall be inserted as indicated. This percentage value shall include all profits for site office, head office and other overheads.

GRAND SUMMARY

S.NO:	DESCRIPTION	AMOUNT
A	PRELIMINARIES AND GENERAL REQUIREMENTS	Included in Permanent Works
B	PERMANENT WORKS	
1	CIVIL WORKS	
2	ELECTRICAL WORKS	
	TOTAL COST OF THE PROJECT	

CIVIL WORKS

Construction of Main Substation

S.No	GOVT.OF SINDH CSR 2012 Item #/Page#/ Vol.sched ref.	DESCRIPTION	QTY	UNIT	RATE (To be Fill by bidder) (Rs.)	CSR SINDH SCHD. 2012 RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6	7	8 = (4 x 6)
PART-A (SCHEDULE ITEMS)							
1	Item # 18(b)+18(i.ii)/ P-4+75/ Vol. III,Part- II & III,(General & PHEW)	EXCAVATIONS, BACKFILLING AND DEWATERING Excavation in foundation and dewatering in all kind of soil of building, bridges and other structures including dagbelling dressing refilling around structure with (suitable) excavated earth watering, ramming complete and disposal of surplus excavated material to designated area i/c all lead & lift. etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	100	M ³		303.92	
2	Item # 22+13 (b+cii)/P-3 & 4/Vol-III,Part-II, (General)	IMPORTED EARTH FILLING FROM OUTSIDE SOURCES Supplying and filling watering and ramming earth under floor with new earth excavated from outside in 150mm layers leveling dressing and watering for compaction and to obtain 95% modified AASHTO density. Complete including all lead & lifts etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	253	M ³		167.42	
3	Item # 2 / P-15 /Vol-III,Part-II, (General)	STONE SOLING Providing and laying dry rammed brick or stone ballast / soling 1-1/2" to 2" gauge from approved quarry including hand packing & filling voids with spraws & chips, consolidating & compacting with power or hand roller,etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	97	M ³		1,175.27	
4	Item # 5(l) / P-16 /Vol-III,Part-II, (General)	PCC CONCRETE (1:4:8) Providing and laying cement concrete plain including placing compacting, finishing, leveling and curing (including screening and washing at stone aggregate without shuttering etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.					
a)		Below foundation, plinth beam etc.	5	M ³		3,987.19	
b)		Under floor and where required etc.	4	M ³		3,987.19	
5	Item # 5(h) / P-16 /Vol-III,Part-II, (General)	PCC CONCRETE (1:3:6) Providing and laying cement concrete plain including placing compacting, finishing, leveling and curing (including screening and washing at stone aggregate without shuttering etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	1	M ³		4,448.55	
6	Item # 19b(i+ii/2) / P-18 /Vol-III,Part-II, (General)	WOODEN FORMWORKS/SHUTTERING Providing, fixing, erecting and removal of partial wood centering (shuttering / formwork) of approved quality for RCC or plain cement concrete works etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.					
i		Form work for 1:4:8 concrete	12	M ²		361.31	
ii		Form work for 1:3:6 concrete	6	M ²		361.31	

Construction of Main Substation

S.No	GOVT.OF SINDH CSR 2012	DESCRIPTION	QTY	UNIT	RATE (To be Fill by bidder) (Rs.)	CSR SINDH SCHD. 2012 RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.						
1	2	3	4	5	6	7	8 = (4 x 6)
7	Item # 6a(ii) / P-16,17 /Vol-III,Part-II, (General)	<p>RCC CONCRETE SUB-STRUCTURE-Providing and laying Reinforced cement concrete work including all labor and material except the cost of steel reinforcement and its labor for bending and binding which will be paid separately.This rate also includes all kinds of forms moulds lifting fixing of shuttering and its removal and vibrating, curing, rendering and finishing the exposed surface (including screening and washing of shingle) etc. complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.</p> <p>RCC Concrete Cylindrical strength 21 Mpa (3000 Psi)</p> <p>i) Footing and Concrete Pads</p> <p>ii) Plinth Beams</p> <p>iii) Column up to Plinth level</p> <p>iv) Cable Trench (Wall & Slab)</p>	6	M ³		12,326.68	
8	Item # 8b / P-17 /Vol-III,Part-II, (General)	<p>STEEL REINFORCEMENT Providing, supplying, cutting, fabrication of Tor / deformed steel reinforcement for cement concrete including cutting,bending,laying in position making joints and fastening including cost of binding wire (also includes removal of) etc. complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.</p>	2	Ton		100,034	
9	Item # 9 / P-71 /Vol-III,Part-II, (General)	<p>BITUMEN COATING Providing and applying industrial bitumen paint/coating to plastered or cement concrete surface etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer</p>	58	M ²		83.72	
10	Item # 28b / P-19 / Vol-III,Part-II,(General)	<p>(D.P.C) DAMP PROOF COURSE Providing and laying DPC damp proof course with (cement sand and shingle concrete 1:2:4) including 2 coats of asphaltic mixture with leveling, curing, finishing etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.</p>	4	M ²		421.02	
11	Item # 92 / P-109 / Vol-III,Part-II,(General)	<p>TERMITE TREATMENT Providing Anti-Termite treatment by spraying / sprinkling / spreading Neptachlar 0.5% Emulsion as an overall pre-construction treatment in slab type construction under the slab and along attached perches or entrances etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. <i>(Plinth area will be measured one time for payment whereas the number of applications will be three times on all horizontal & vertical surfaces of the excavations for termite proofing).</i></p>	192	M ²		104.80	

Construction of Main Substation

S.No	GOVT.OF SINDH CSR 2012 Item #/Page#/ Vol.sched ref.	DESCRIPTION	QTY	UNIT	RATE (To be Fill by bidder) (Rs.)	CSR SINDH SCHD. 2012 RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6	7	8 = (4 x 6)
12	Item # 6a(ii) / P-16,17 /Vol-III,Part-II, (General)	<p>RCC CONCRETE SUPER-STRUCTURE-Providing and laying Reinforced cement concrete work including all labor and material except the cost of steel reinforcement and its labor for bending and binding which will be paid separately.This rate also includes all kinds of forms moulds lifting fixing of shuttering and its removal and vibrating, curing, rendering and finishing the exposed surface (including screening and washing of shingle) etc. complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.</p> <p>RCC Concrete Cylindrical strength 21 Mpa (3000 Psi)</p> <p>i) Column</p> <p>ii) Beams. Lintels, Projections, Pads, brackets and Sills</p> <p>iii) Slab i/c Projection</p>	4	M ³		12,326.68	
13	Item # 8b / P-17 /Vol-III,Part-II, (General)	<p>STEEL REINFORCEMENT Providing, supplying, cutting, fabrication of Tor / deformed steel reinforcement for cement concrete including cutting,bending,laying in position making joints and fastening including cost of binding wire (also includes removal of) etc. complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.</p>	2	Ton		100,034	
14	Item # 5(1e) / P-21 /Vol-III,Part-II, (General)	<p>BRICK MASONRY Providing and laying pacca brick masonry work (1st class quality) in ground floor super structure up to any height and at any floor etc. laid and jointed with 1:6 cement sand mortar using approved quality screened sand including racking out and cleaning of joints and pointing, masonry to be laid in course, true to line, level and plumb, properly cured, etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.</p>	17	M ³		4,476.58	
15	Item # 11b / P-52 / Vol. III,Part-II,(General)	<p>PLASTER (INTERNAL WALL SURFACE) Providing and applying 15mm (1/2") thick cement plaster to internal walls, columns, beams, etc. with cement mortar 1:4 ic all corners, recesses, jambs, raking out joints of masonry, scaffolding etc, complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. (up to any height).</p>	120	M ²		245.75	
16	Item # 30a+b / P-73/ Vol.III,Part II, (General)	<p>PAINT (INTERNAL WALL SURFACE) Providing and applying painting on all internal wall surface with Enamel Paint of approved shade three coats over and including a coat of primer over plastered surface at any height in any floor including preparation of surface, filling depression with putty, rubbing, sand papering and cleaning etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.</p>	120	M ²		152.98	

Construction of Main Substation

S.No	GOVT.OF SINDH CSR 2012 Item #/Page#/ Vol.sched ref.	DESCRIPTION	QTY	UNIT	RATE (To be Fill by bidder) (Rs.)	CSR SINDH SCHD. 2012 RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6	7	8 = (4 x 6)
17	Item # 10b / P-52 / Vol. III,Part-II,(General)	PLASTER (INTERNAL CEILING SURFACE) Providing and applying 15mm (1/2") thick cement plaster to internal ceiling, soffits of beams and projections etc. with cement mortar 1:3 ic all corners, recesses, jambs, raking out joints of masonry, scaffolding etc, complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. (up to any height).	57	M ²		252.28	
18	Item # 30a+b / P-73/ Vol.III,Part II, (General)	PAINT (INTERNAL CEILING SURFACE) Providing and applying painting on all ceiling surface with Enamel Paint of approved shade three coats over and including a coat of primer over plastered surface at any height in any floor including preparation of surface, filling depression with putty, rubbing, sand papering and cleaning etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	57	M ²		152.98	
19	Item # 13c / P-52 / Vol. III,Part-II,(General)	PLASTER (EXTERNAL SURFACE) Providing and applying 20mm (3/4") thick cement plaster to external walls, columns, beams, etc. with cement mortar 1:6 ic all corners, recesses, jambs, raking out joints of masonry, scaffolding etc, complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. (up to any height).	147	M ²		278.74	
20	Item # 38a+b+b / P-56 / Vol.III,Part II, (General)	PAINT (WEATHERSHIELD ON EXTERNAL SURFACE) Providing and applying preparing the surface and painting with weather coat i/c rubbing the surface with rubbing brick /sand paper, filling the voids with chalk/ plaster of Paris and then painting with weather coat of approved make (1st coat, 2nd & subsequent coat) etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. (At any height)	147	M ²		276.31	
21	Item # 2+3 / P-91/ Vol.III,Part II, (General)	MS WORKS Providing, fabrication, erecting and fitting in position of heavy steel works with (angles,tees,flat iron, round iron and sheet iron for making trusses, girders, tanks etc.including cutting tanks etc. including cutting, drilling, riveting, handling assembling and fixing in position etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.					
i		For MS Louvered Door	29	Kg		103.99	
ii		For MS Windows	63	Kg		103.99	
iii		For MS Chequered Plat over cable trench	560	Kg		103.99	

Construction of Main Substation

S.No	GOVT.OF SINDH CSR 2012	DESCRIPTION	QTY	UNIT	RATE (To be Fill by bidder) (Rs.)	CSR SINDH SCHD. 2012 RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.						
1	2	3	4	5	6	7	8 = (4 x 6)
22	Item # 5d('i,ii)/ P-70 / Vol.III,Part II, (General)	<p>PAINT (ON MS WORKS) Providing and applying preparing the surface and painting in all types of MS guard bars, gates of iron bars, grating, railings (including standard braces etc) and similar open work with priming coat / enamel coating of approved make (1st coat, 2nd & subsequent coat) etc complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. (At any height)</p>	52	M ²		136.74	
Total Amount of Schedule Items-A							
PART-B (NON-SCHEDULE ITEMS)							

Construction of Main Substation

S.No	GOVT.OF SINDH CSR 2012	DESCRIPTION	QTY	UNIT	RATE (To be Fill by bidder) (Rs.)	CSR SINDH SCHD. 2012 RATE (Rs.)	AMOUNT (Rs.)
	Item #/Page#/ Vol.sched ref.						
1	2	3	4	5	6	7	8 = (4 x 6)
23		<p>ROOF PROTECTION Providing & laying complete roof water treatment at any floor and any height as shown in the drawings & details consisting of following items complete in all respect as per drawing, standards, specifications and direction of the Engineer. (For payment roof screed area will be measured)</p> <p>i) Providing and laying 25mm thick average with (1:4) cement sand mortar base plaster for achieving leveled surface. ii) Providing and laying in position sticking coat of Bitumen 70-90 Grade @ 10 Lbs /10 Sqm iii) Providing and laying in position flood coat of Bitumen 10-20 Grade @ 35 Lbs /10 Sqm iv) Providing and laying 75mm thick minimum (1:2:4) with 3000 psi strength concrete screed including Fiber mesh 150 @ 0.05 Lbs/cement bag of approved equivalent in required slope curing, making ridges, valleys, champhered edges etc</p>	50	M ²		-	
24		<p>FLOORING Providing, and laying 50mm thick 1:2:4 granolithic floor finish including compacting, paneling, leveling, finishing and curing (over all thickness shown in drawings) etc, complete in all respect as per drawing, standard, specifications and direction of the Engineer.</p>	47	M ²		-	
25		<p>WATER SPOUT Providing & Fixing CC precast or cast in situ water spout 450 mm x 450 mm for rain water drain (at any floor & height) as per given details shown in drawings etc, complete in all respect as per drawing, standard, specifications and direction of the Engineer.</p>	1	Each		-	
26		<p>Providing and fixing of 100 mm dia PVC pipes and fittings as per BS & ASTM standard for rain water pipes including non struct concrete around pipes, silicon mastic filling, jali, cleanout plug, clamps, hanger collars, supports, specials (bend, tees, Y-tee etc) as shown in the drawing, (at any floor & height) as per given drawing etc, complete in all respect as per drawing, standard, specifications and direction of the Engineer.</p>	4	Rm		-	
Total Amount of Non-Schedule Items-B							
TOTAL AMOUNT CARRIED TO GRAND SUMMARY A+B							

ELECTRICAL WORKS

Item No.	Description	Qty.	Unit	Rate (Rupees)	Amount (Rupees)
Non Schedule Items					
E-1	MV SWITCHBOARD Supply, installing, testing & commissioning of following floor standing totally enclosed, cubical type, dust protected and vermin proof, medium voltage switchgear including all component, Control wiring as per specifications and drawing. Complete in all respect. 12 kV,1250 AMP, VCB Switchgear	1	Job.		
E-2	Providing, and laying of Rubber insulation mat 1 meter wide and 6mm thick to be installed all along MV Panel in Substation,suitable to provide insulation for 15 kV working as per the requirement and specification, complete in all respect.	1	Job.		
E-3	Providing and fixing of Danger Board,Shock chart, First chart having signs & designation on external doors of Sub-Station.	1	Job.		

Item No.	Description	Qty.	Unit	Rate (Rupees)	Amount (Rupees)
Non Schedule Items					
E-4	MV CABLE Providing, laying, termination, testing and commissioning of following 15 KV Aluminium conductor M.V cable from SEPCO to Main Substation and Main Substation to Substation No.1,2,3 & 4, directly laid in ground and partly in already laid PVC ducts, as per drawings and specification, including, cable lugs, cable glands, 300x300x50 mm concrete tile, warning tape, identification markers, etc., complete in all respect.				
i	3 core-300 Sq.mm Al. XLPE /SWA/ PVC Cable	5700	Rm		
ii	3 core-240 Sq.mm Al. XLPE /SWA/ PVC Cable	4220	Rm		
E-5	Providing, termination, testing and commissioning of following termination kits and joints of approved manufacturer, as per specification and detail shown on drawing, with all accessories, complete in all respect.				
i	MV termination Kit 300 sq.mm 3 Core (In door)	4	Nos.		
ii	MV termination Kit 300 sq.mm 3 Core (Out door)	4	Nos.		
iii	MV termination Kit 240 sq.mm 3 Core (In door)	16	Nos.		
iv	MV Straight Joint Kit 300 sq.mm 3 Core (Outdoor)	10	Nos.		
v	MV Straight Joint Kit 240 sq.mm 3 Core (Outdoor)	8	Nos.		
E-6	Excavation of trench, in hard / soft soil (including excavation for cable loops) and back filling after laying of cable, cost including providing fresh sand 100 mm above and 100 mm under cable, laying protection concrete tile on sand, warning tape and backfilling, compaction etc., as per detail shown on drawing, complete in all respect.	2600	Cu.m		

Item No.	Description	Qty.	Unit	Rate (Rupees)	Amount (Rupees)
Non Schedule Items					
	LOW VOLTAGE CABLES				
E-7	Providing, laying, testing, termination at both ends and commissioning of following Aluminium conductor armoured cables, directly under ground and partly already laid PVC ducts of size as may required, as per drawings and specification, including cable glands, identification markers, etc.,excavation & filling of trench as per specification, complete in all respect.				
i	4c-10 Sq.mm Al.PVC/SWA/PVC (600/1000V)	170	Rm		
ii	1c-6 Sq.mm Cu.PVC as ECC (450/750V)	170	Rm		

Item No.	Description	Qty.	Unit	Rate (Rupees)	Amount (Rupees)
Non Schedule Items					
EARTHING SYSTEM					
E-8	Providing and prepare Earth pit with 600 mm x 600 mm x 3 mm thick copper plate type electrode for earthing system, including cost of excavation up to water level, with filling mixture material as per specification to achieve earthing resistance not more than 1 ohm, connection with earth leads of 2 x 70 sq.mm Bare copper conductor up to earth testing point, Inspection pit 600 mm x 600 mm x 450 mm deep (min) with 450 mm dia heavy duty C.I cover , complete as per detail drawing & instruction of consultant. providing as built drawings, test reports documents to Employer / Consultant representative. Complete in all respect.	2	Nos.		
E-9	Providing, installation, testing and commissioning of 70 sq.mm hard drawn bare Cu.Conductor as earth continuity conductor (ECC) installed on surface or in already installed raceway or in already excavated trench or in already laid pipe complete in all respect.	80	Rm		
E-10	Providing, installation, testing and commissioning of Copper Earth connecting Bar 300 mm x 50 mm x 06 mm for earthing system as per drawings and instruction of consultant, including all mounting accessories etc., complete in all respect.	1	No.		

Item No.	Description	Qty.	Unit	Rate (Rupees)	Amount (Rupees)
Non Schedule Items					
E-11	uPVC Pipe Providing and laying of following size uPVC class "D" pipe for opening sleeves of sub station to buildings. Buried in ground, under roads crossing as per drawing. Including excavation for laying of pipe, 5 mm dia nylon rope,backfilling with new and fresh sand (100 mm under and 100 mm above pipe) , compaction and plugging of pipe ends etc., as shown on drawing, complete in all respect.				
i	150 mm (internal dia)	20	Rm		
ii	100 mm (internal dia)	1	Rm		
E-12	DISTRIBUTION BOARDS. Supply,installation,testing & commissioning of surface/recessed mounted DB-MSS as per single line diagram and specifications,with all accessories including civil works,approved by engineer,complete in all respect.	1	Job.		

Item No.	Description	Qty.	Unit	Rate (Rupees)	Amount (Rupees)
Non Schedule Items					
LIGHTING FIXTURES					
E-13	Supply, installation, testing and commissioning of following light fixtures complete with Electronic ballast (unless mention otherwise),lamps, lamps holder,all mounting accessories etc.,as per drawing and specification,complete in all respects.				
i	Surface mounted Fluorescent light fixture Philips TMS or Approved Equivalent type with 2×28 W TL5 Color 84 lamp	6	Nos.		
ii	Surface/Wall mounted Bulkhead Outdoor light fixture (IP-65) with 1×18W CFL lamp.	1	No.		
FANS					
E-14	Supply, installation, testing and commissioning of 16" dia Exhaust Fan Metal body with Louvre ,as per specification,complete in all respects.	2	Nos.		
LIGHTING CONTROL SWITCH					
E-15	Supply,installation,testing and commissioning of10 Amps,5- gang switch,including 16 SWG sheet steel powder coated back boxes, recessed in wall with all accessories,as per specification, complete in all respects.	1	No.		
SWITCH SOCKET OUTLET					
E-16	Supply, installation, testing and commissioning of 15 Amps,3Pin switch socket outlet, including 16 SWG sheet steel powder coated back boxes, recessed in wall with all accessories,as per specification, complete in all respects.	2	Nos.		

Item No.	Description	Qty.	Unit	Rate (Rupees)	Amount (Rupees)
Non Schedule Items					
E-17	WIRING Supply, installation, testing & commissioning of circuit wiring from DB to switch board with 3x2.5 sq.mm single core, Cu. conductor PVC insulated wires including 25 mm dia. PVC conduit surface / recessed in wall, column, ceiling, etc., complete with all accessories, as per specification, complete in all respect.	1	No.		
E-18	Supply, installation, testing & commissioning of wiring from switch board to light /fan point with 3x1.5 sq.mm. single core, Cu. conductor PVC insulated wires including 20 mm dia PVC conduit, surface / recessed with all accessories, complete in all respect.	5	Nos.		
E-19	Supply, installation, testing & commissioning of wiring between light point to light point with 3x1.5 sq.mm single core Cu. conductor PVC insulated wires including 20 mm dia PVC conduit, surface / recessed with all accessories, as per specification, complete in all respect.	4	Nos.		
E-20	Supply, installation, testing & commissioning of circuit wiring for Power socket outlet with 2 x 4 sq.mm. + 1x 4 sq.mm. as ECC, single core Cu. conductor PVC installed wire including 20 mm dia. PVC conduit surface / recessed in wall, column, ceiling, etc., complete with all conduit accessories as per drawings and specification.	2	Nos.		
Total Cost of Electrical Works					

RATE ANALYSIS

VOLUME-VI DRAWINGS

PROJECT OFFICE
KHAIRPUR SPECIAL ECONOMIC ZONE (KSEZ)
DISTRICT KHAIRPUR

CONSTRUCTION OF
MAIN SUBSTATION

TENDER DRAWINGS
(STRUCTURAL)

DECEMBER, 2015



CONSULTING ENGINEERS & ARCHITECTS
ECONOMISTS AND PLANNING EXPERTS
AL-9, 15TH LANE, KHAYBAN-E-HILAL, PHASE - VII, D.H.A KARACHI-75500
PHONE NO. 5841821 - 24

Drawing No.: EA-660-MST-S-0100	
Project Code: 660	Rev.: 0
Drawn: A.A.G.	Date: DEC.2015
Scale / Sheet: AS SHOWN	MS
Designed: A.K.	Checked: K.M.
Approved: _____	
Drawing Title: COLUMN / FOUNDATION LAYOUT PLAN	

Guiding Name: MAIN SUBSTATION

Status: TENDER

Structural

Date of Issue: December, 2015	Issued To: Client	Issued For: Tender
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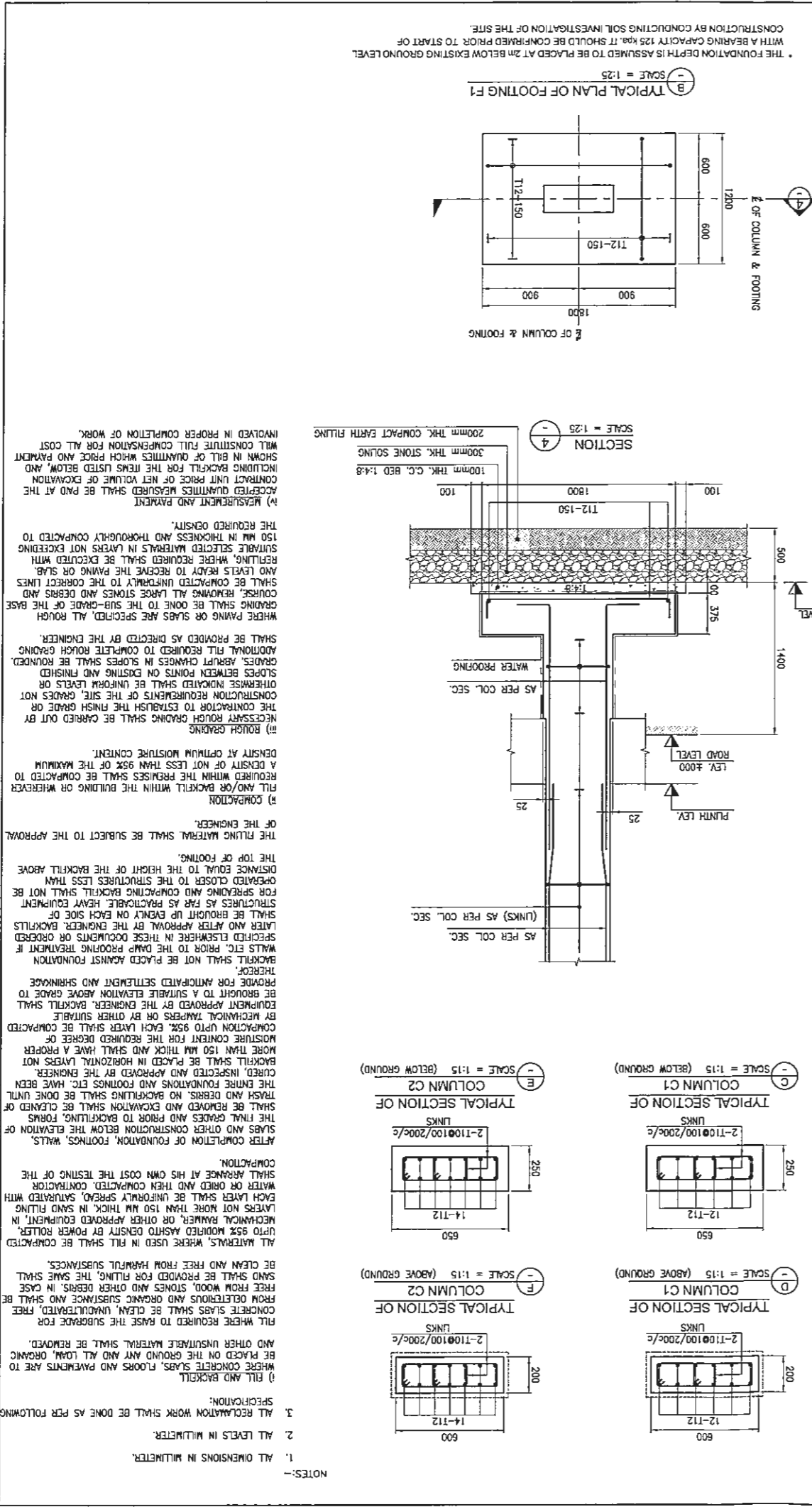
Mark	Date	Description	Sig.
0	REV. 15	ISSUED FOR TENDER	

3. CONCRETE CYLINDRICAL STRENGTH IS 21 Mpa (3000 psi).
2. ALL LEVELS IN METERS.
1. ALL DIMENSIONS IN MILLIMETER.

Client: CITY DISTRICT GOVERNMENT KHAIRPUR

EA Consulting Pvt Ltd
 Head Office: 9-151 Lane, Koyabehn-4th Phase 2, Defence Housing Authority, Karachi 75500. Fax No. 564-1825. Email: info@ehc.com | www.ehconline.com

Special Economic Zone KHAIRPUR



- NOTES:-
1. ALL DIMENSIONS IN MILLIMETER.
 2. ALL LEVELS IN MILLIMETER.
 3. ALL RECLAMATION WORK SHALL BE DONE AS PER FOLLOWING SPECIFICATION:

(1) FILL AND BACKFILL WHERE CONCRETE SLABS, FLOORS AND PAVEMENTS ARE TO BE PLACED ON THE GROUND AND ALL LOAM, ORGANIC AND OTHER UNSUITABLE MATERIAL SHALL BE REMOVED.

(2) ALL RECLAMATION WORK SHALL BE DONE AS PER FOLLOWING SPECIFICATION:

(3) FILL AND BACKFILL WHERE CONCRETE SLABS, FLOORS AND PAVEMENTS ARE TO BE PLACED ON THE GROUND AND ALL LOAM, ORGANIC AND OTHER UNSUITABLE MATERIAL SHALL BE REMOVED.

(4) ALL MATERIALS, WHERE USED IN FILL SHALL BE COMPACTED UP TO 95% MODIFIED AASHTO DENSITY BY POWER ROLLERS. MECHANICAL RAMMER, OR OTHER APPROVED EQUIPMENT, IN LAYERS NOT MORE THAN 150 MM THICK, IN SAND FILLING EACH LAYER SHALL BE UNIFORMLY SPREAD, SATURATED WITH WATER OR OILED AND THEN COMPACTED. CONTRACTOR SHALL ARRANGE AT HIS OWN COST THE TESTING OF THE COMPACTION.

(5) AFTER COMPLETION OF FOUNDATION, FOOTINGS, WALLS, SLABS AND OTHER CONSTRUCTION BELOW THE ELEVATION OF THE FINISH GRADE, BACKFILLING SHALL BE DONE UNTIL THE FINISH GRADE AND EXCAVATION SHALL BE CLEARED OF TRASH AND DEBRIS AND FOUNDATIONS ETC. HAVE BEEN CHECKED, INSPECTED AND APPROVED BY THE ENGINEER. BACKFILL SHALL BE PLACED IN HORIZONTAL LAYERS NOT MORE THAN 150 MM THICK AND SHALL HAVE A PROPER MOISTURE CONTENT FOR THE REQUIRED DENSITY OF COMPACTION UP TO 95%. EACH LAYER SHALL BE COMPACTED BY MECHANICAL TAMPERS OR BY OTHER SUITABLE EQUIPMENT APPROVED BY THE ENGINEER. BACKFILL SHALL BE BROUGHT TO A SUITABLE ELEVATION ABOVE GRADE TO PROVIDE FOR ANTICIPATED SETTLEMENT AND SHRINKAGE THEREOF.

(6) BACKFILL SHALL NOT BE PLACED AGAINST FOUNDATION WALLS ETC. PRIOR TO THE DAMP PROOFING TREATMENT IF SPECIFIED ELSEWHERE IN THESE DOCUMENTS OR ORDERED LATER AND AFTER APPROVAL BY THE ENGINEER. BACKFILLS SHALL BE BROUGHT UP TO EACH SOLE OF FOUNDATIONS AS FAR AS PRACTICABLE. HEAVY EQUIPMENT FOR SPREADING AND COMPACTING BACKFILL SHALL NOT BE OPERATED CLOSER TO THE STRUCTURE LESS THAN DISTANCE EQUAL TO THE HEIGHT OF THE BACKFILL ABOVE THE TOP OF FOOTING.

(7) ALL LEVELS IN METERS.

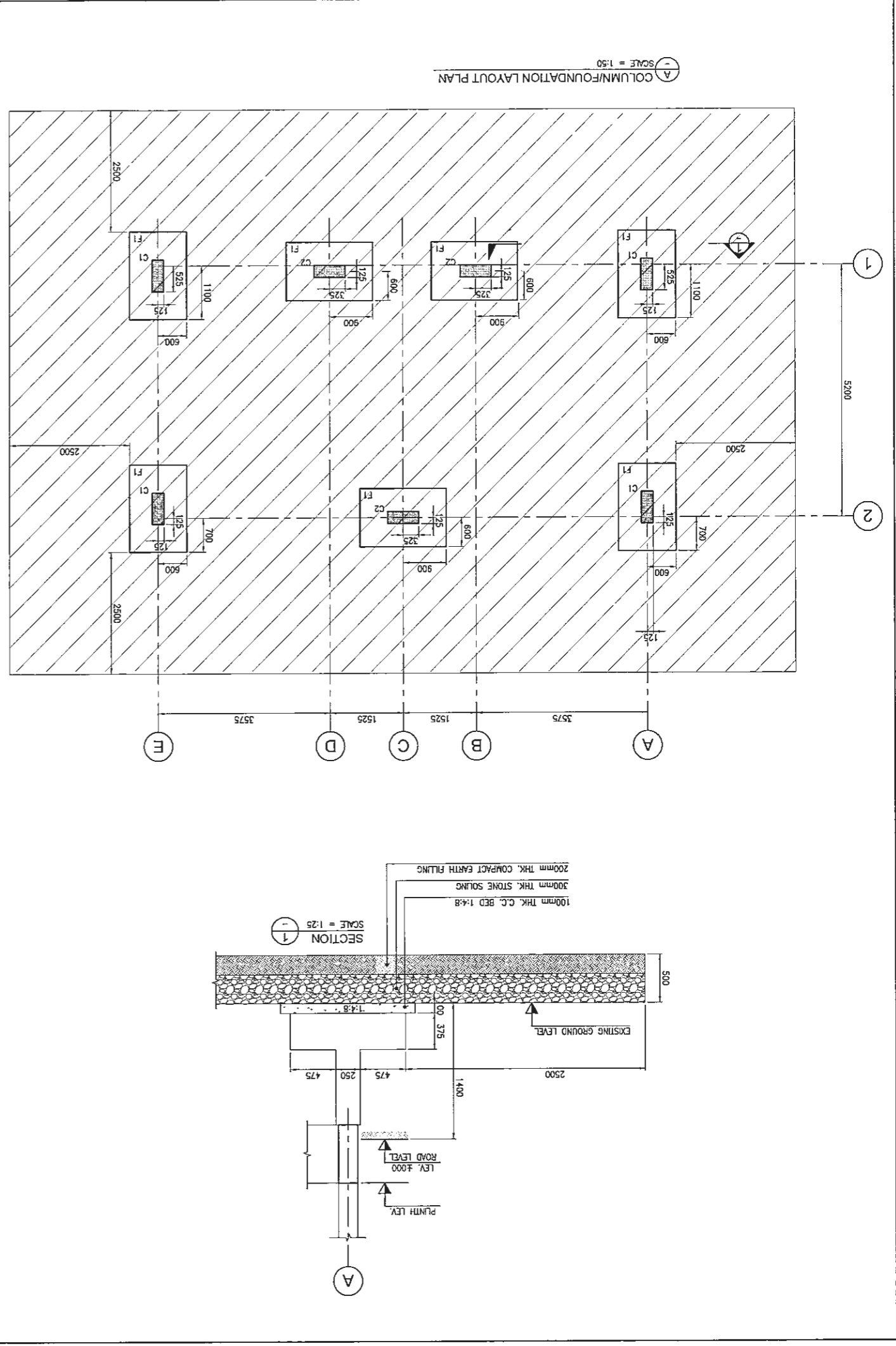
(8) CONCRETE CYLINDRICAL STRENGTH IS 21 Mpa (3000 psi).

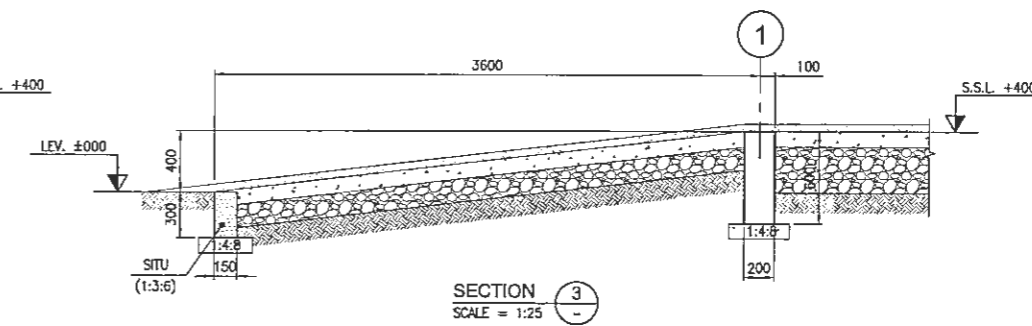
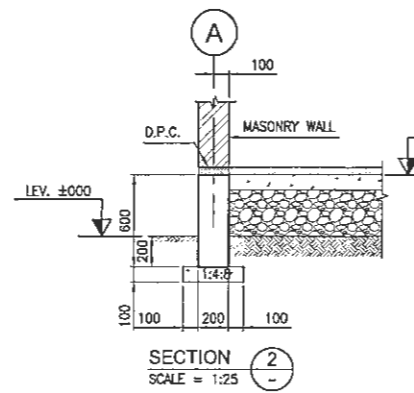
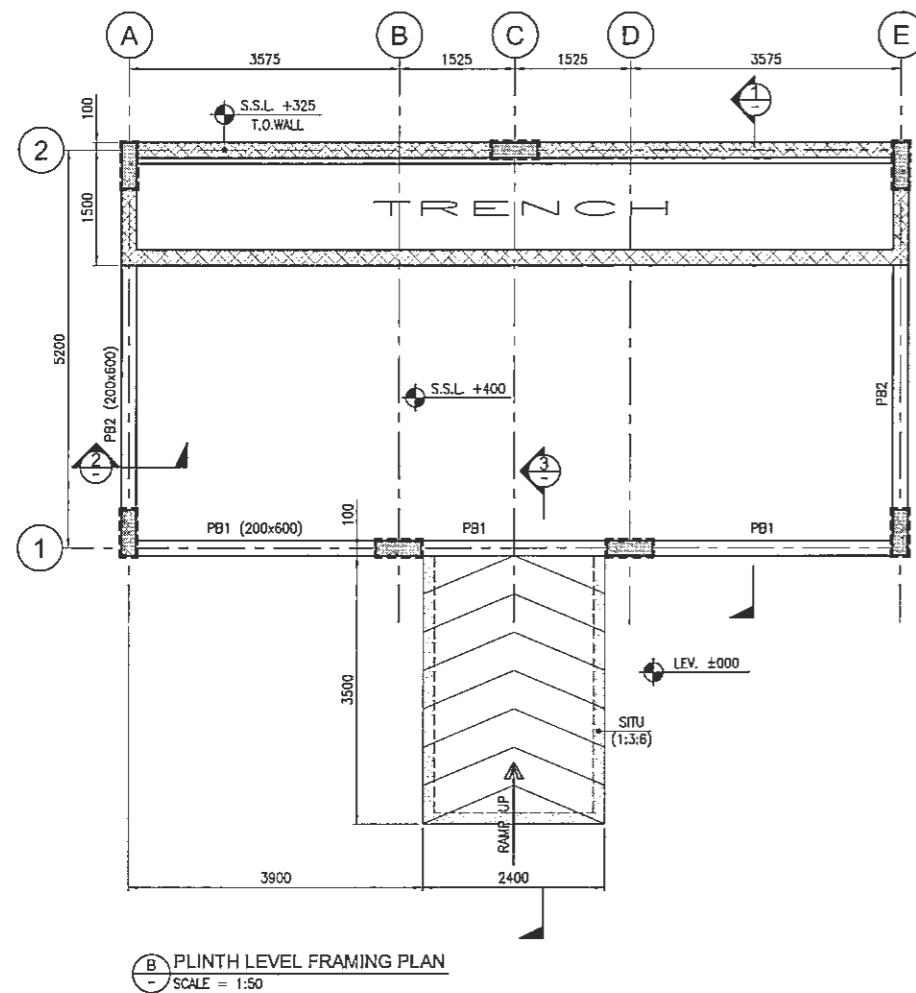
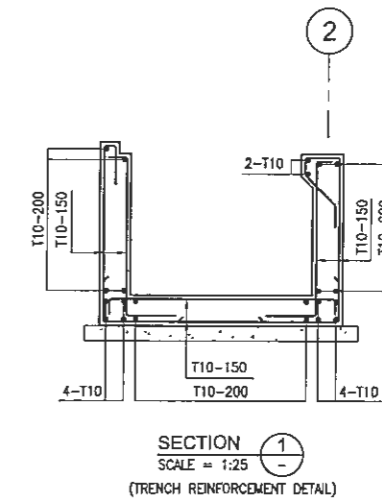
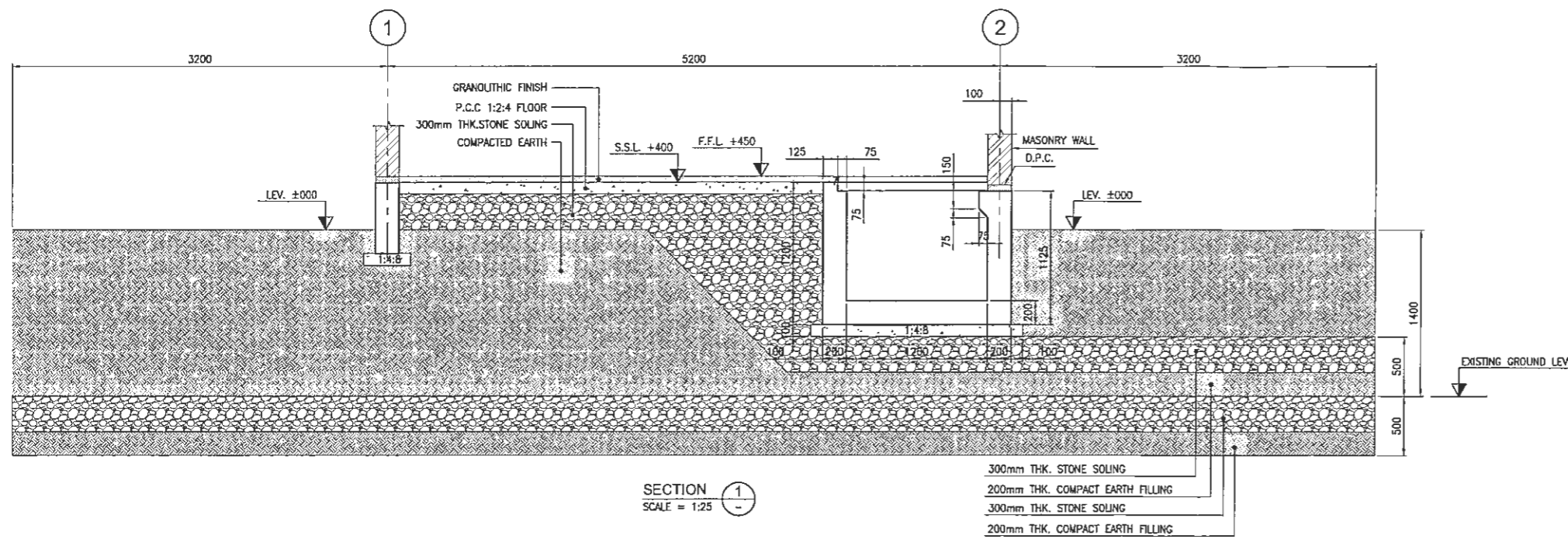
(9) ROUGH GRADING NECESSARY ROUGH GRADING SHALL BE CARRIED OUT BY THE CONTRACTOR TO ESTABLISH THE FINISH GRADE OR CONSTRUCTION REQUIREMENTS OF THE SITE. GRADES NOT OTHERWISE INDICATED SHALL BE UNIFORM LEVELS OR SLOPES BETWEEN POINTS ON EXISTING AND FINISHED GRADES. REPORT CHANGES IN SLOPES SHALL BE ROUNDED DOWN TO COMPLETE TO THE ENGINEER.

(10) WHERE PAVING OR SLABS ARE SPECIFIED, ALL ROUGH GRADING SHALL BE DONE TO THE SUB-GRADE OF THE BASE COURSE, REMOVING ALL LARGE STONES AND DEBRIS AND SHALL BE COMPACTED UNIFORMLY TO THE CORRECT LINES AND LEVELS READY TO RECEIVE THE PAVING OR SLAB. REPAIRING, WHERE REQUIRED SHALL BE EXECUTED WITH SUITABLE SELECTED MATERIALS IN LAYERS NOT EXCEEDING 150 MM IN THICKNESS AND THOROUGHLY COMPACTED TO THE REQUIRED DENSITY.

(11) MEASUREMENT AND PAYMENT SHALL BE PAID AT THE CONTRACT UNIT PRICE OR NET VOLUME OF EXCAVATION INCLUDING BACKFILL FOR THE LISTED BELOW AND SHOWN IN BILL OF QUANTITIES WHICH PRICE AND PAYMENT WILL CONSTITUTE FULL COMPENSATION FOR ALL COST INVOLVED IN PROPER COMPLETION OF WORK.

THE FOUNDATION DEPTH IS ASSUMED TO BE PLACED AT 2m BELOW EXISTING GROUND LEVEL WITH A BEARING CAPACITY 125 KPa. IT SHOULD BE CONFIRMED PRIOR TO START OF CONSTRUCTION BY CONDUCTING SOIL INVESTIGATION OF THE SITE.





Project :
SPECIAL ECONOMIC ZONE KHAIRPUR

Consultant Architect :
EA Consulting Pvt Ltd
Head Office AL-9, 15th Lane, Khayaban-e-Hal Phase 7, Clifton Housing Authority, Karachi-75300 - Pakistan
Phone No. 111-111-584 Fax No. 584-1825
Email : info@asworld.com | www.asworld.com

Client :
CITY DISTRICT GOVERNMENT KHAIRPUR

- NOTES:
1. ALL DIMENSIONS IN MILLIMETER.
 2. ALL LEVELS IN METERS.
 3. CONCRETE CYLINDRICAL STRENGTH (S 21 Mpa (3000 psi)).
 4. FOR BEAM SCHEDULE REFER DWG. NO. EA-660-MST-S-0102.

Mark	Date	Description	Sig.
0	DEC.15	ISSUED FOR TENDER	

REVISIONS

Date of Issue	December, 2015
Issued To	Client
Issued For	Tender

STRUCTURAL

Status: **TENDER**

Building Name: **MAIN SUBSTATION**

Drawing Title :
PLINTH LEVEL FRAMING PLAN AND DETAILS

Designed :	Checked :	Approved :
A.K	K.M	M.S
Drawn :	Date :	Scale / Sheet :
A.A.G.	DEC.2015	AS SHOWN
Project Code :	660	Rev. : 0
Drawing No. :	EA-660-MST-S-0101	

Project:
SPECIAL ECONOMIC ZONE KHAIRPUR

Consultant Architect:
EA Consulting Pvt Ltd
Head Office: AL-9, 15th Lane, Khayaban-e-Hikmat Phase 7, Defence Housing Authority, Karachi, 75500 - Pakistan
Phone No. 111-111-584, Fax No. 584-1825
Email: info@eaconsult.com | www.eaconsult.com

Client:
CITY DISTRICT GOVERNMENT KHAIRPUR

NOTES:
1. ALL DIMENSIONS IN MILLIMETER.
2. ALL LEVELS IN METERS.
3. CONCRETE CYLINDRICAL STRENGTH IS 21 Mpa (3000 psi).

Mark	Date	Description	Sig.
0	DEC.15	ISSUED FOR TENDER	
REVISIONS			

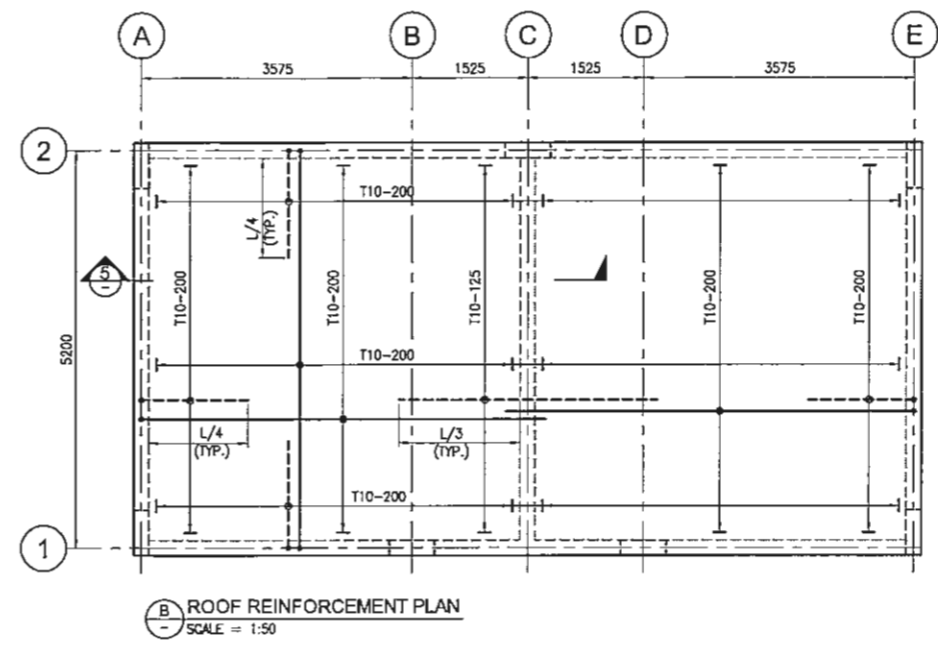
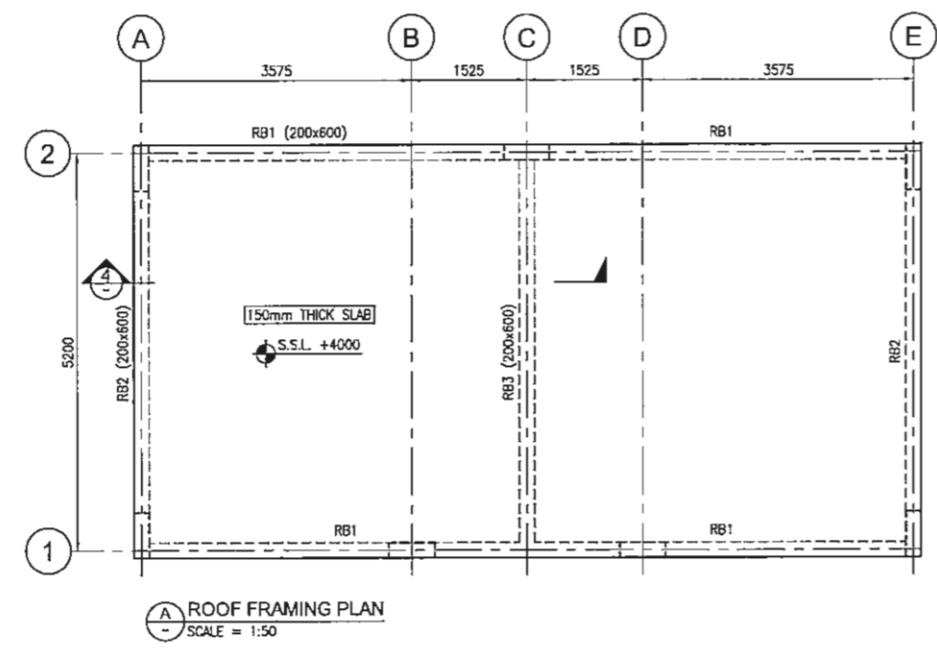
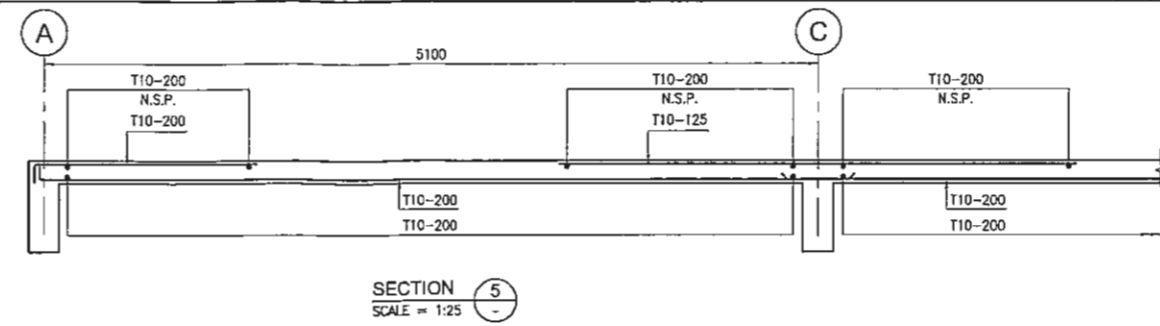
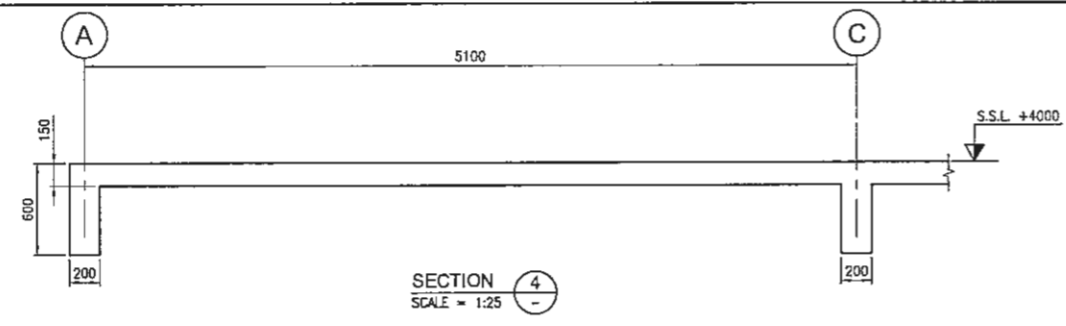
Date of Issue	December, 2015
Issued To	Client
Issued For	Tender

STRUCTURAL
Status: **TENDER**

Building Name:
MAIN SUBSTATION

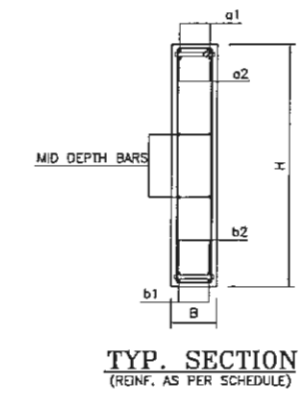
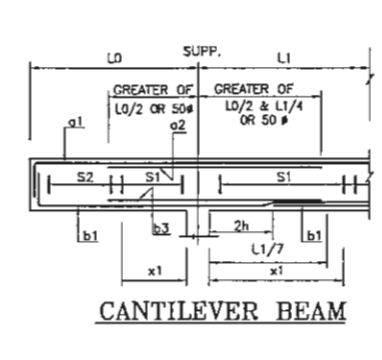
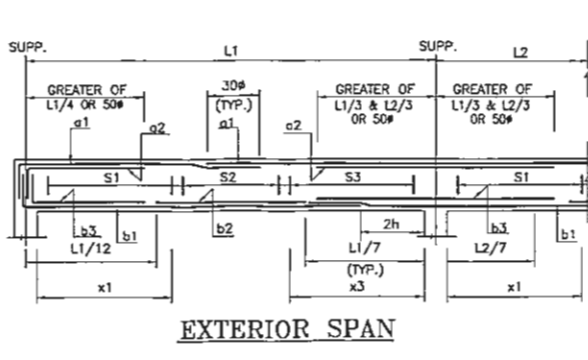
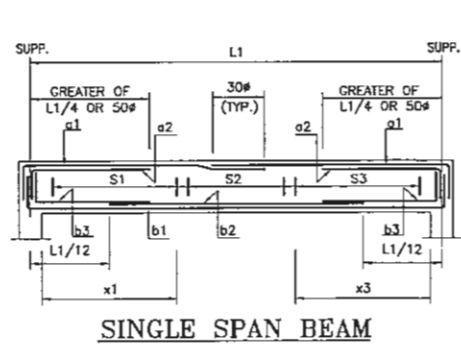
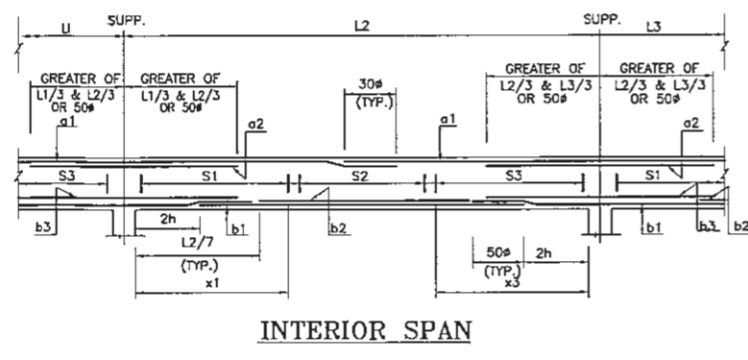
Drawing Title:
ROOF FRAMING & REINFORCEMENT PLAN AND SECTION / BEAM SCHEDULE

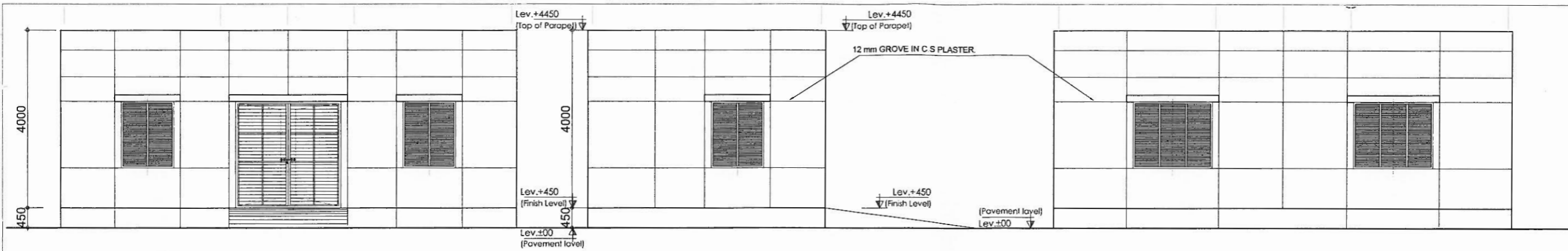
Designed:	Checked:	Approved:
A.K.	K.M.	M.S.
Drawn:	Date:	Scale / Sheet:
A.A.G.	DEC.2015	AS SHOWN
Project Code:	Rev.:	
	660	0
Drawing No.:	EA-660-MST-S-0102	



SCHEDULE OF BEAMS

S.NO	MARK	SIZE		TOP REINFORCEMENT (SUPPORTS)				BOTTOM REINFORCEMENT (SPAN)				STIRRUP (ALL T10 UNLESS SPECIFIED)			MID DEPTH REINF. (EF)	REMARKS
				LEFT/TOP SUPPORT		RIGHT/TOP SUPPORT		b3 (LEFT)		b3 (RIGHT)		s1(x1)	s2	s3(x3)		
		B	H	a1	a2	a1	a2	b1	b2	b3 (LEFT)	b3 (RIGHT)	s1(x1)	s2	s3(x3)		
PLINTH BEAM																
1	PB1	200	600	2-T16	2-T12	2-T16	2-T12	2-T16	-	-	-	100	200	100		EXTERNAL
2	PB2	200	600	2-T16	2-T16	2-T16	2-T16	2-T16	-	2-T12	2-T12	100	200	100		SINGLE
ROOF BEAM																
3	RB1	200	600	2-T16	2-T12	2-T16	2-T12	2-T16	-	-	-	100	200	100		EXTERNAL
4	RB2	200	600	2-T16	2-T12	2-T16	2-T12	2-T16	-	-	-	100	200	100		SINGLE
5	RB3	200	600	2-T16	-	2-T16	-	2-T16	2-T12	-	-	100	200	100		SINGLE

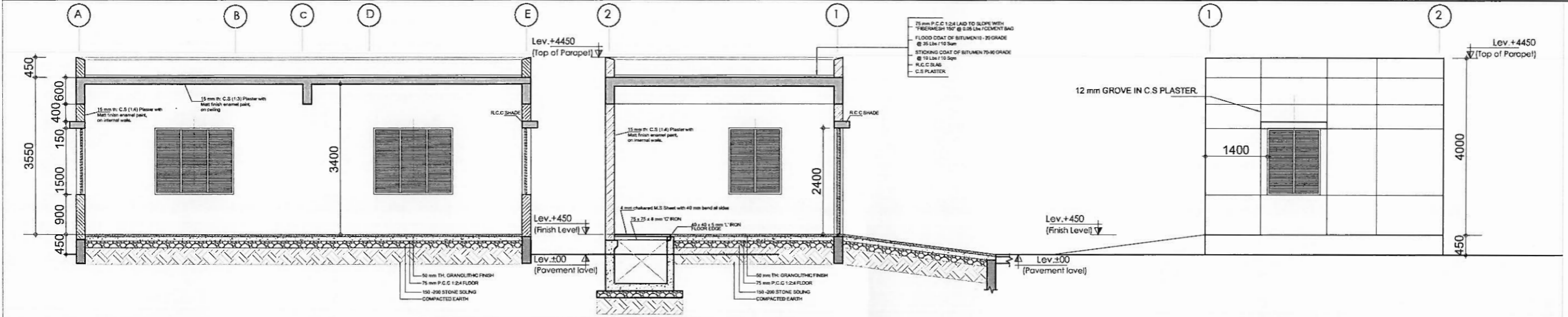




ELEVATION-1

ELEVATION-2

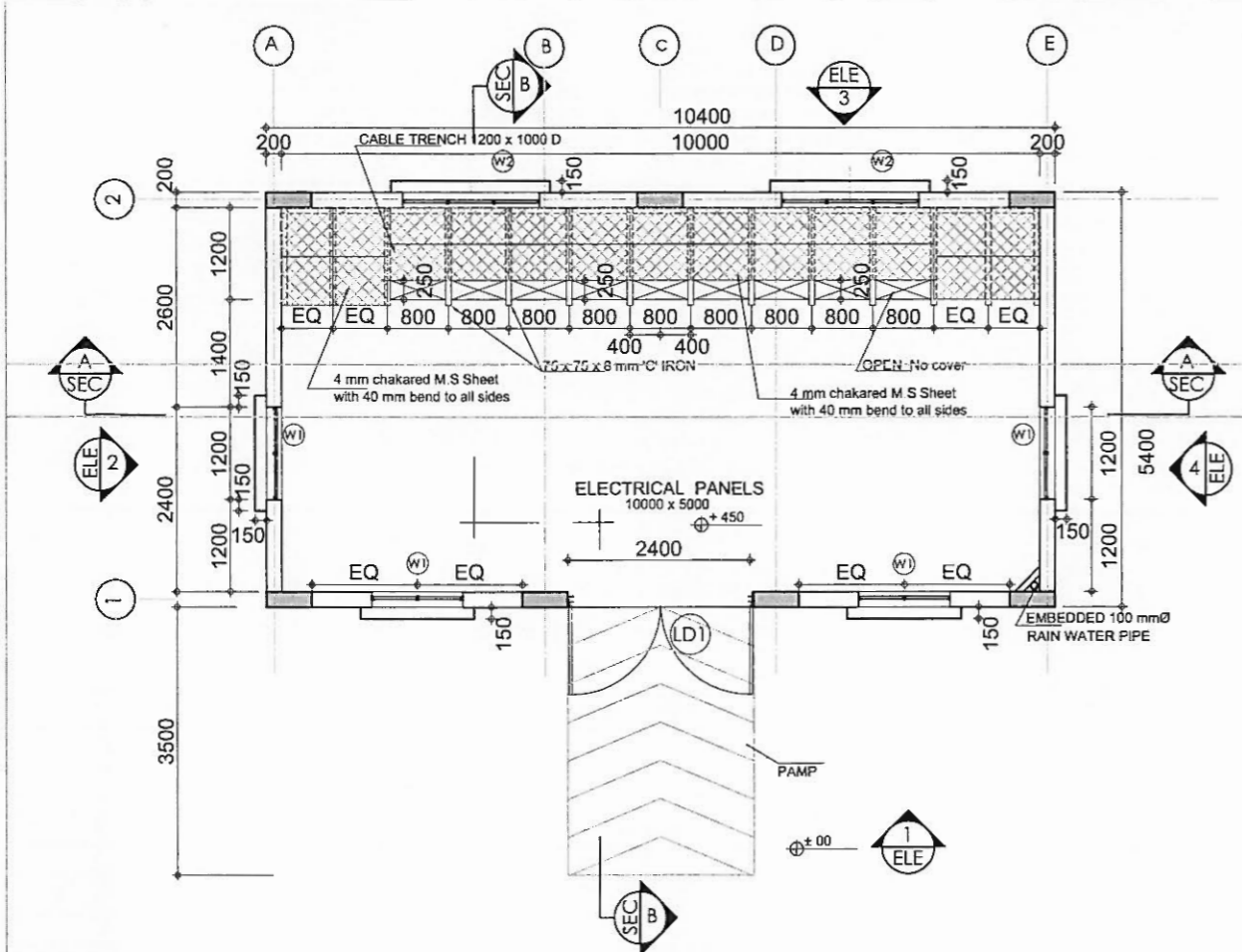
ELEVATION-3



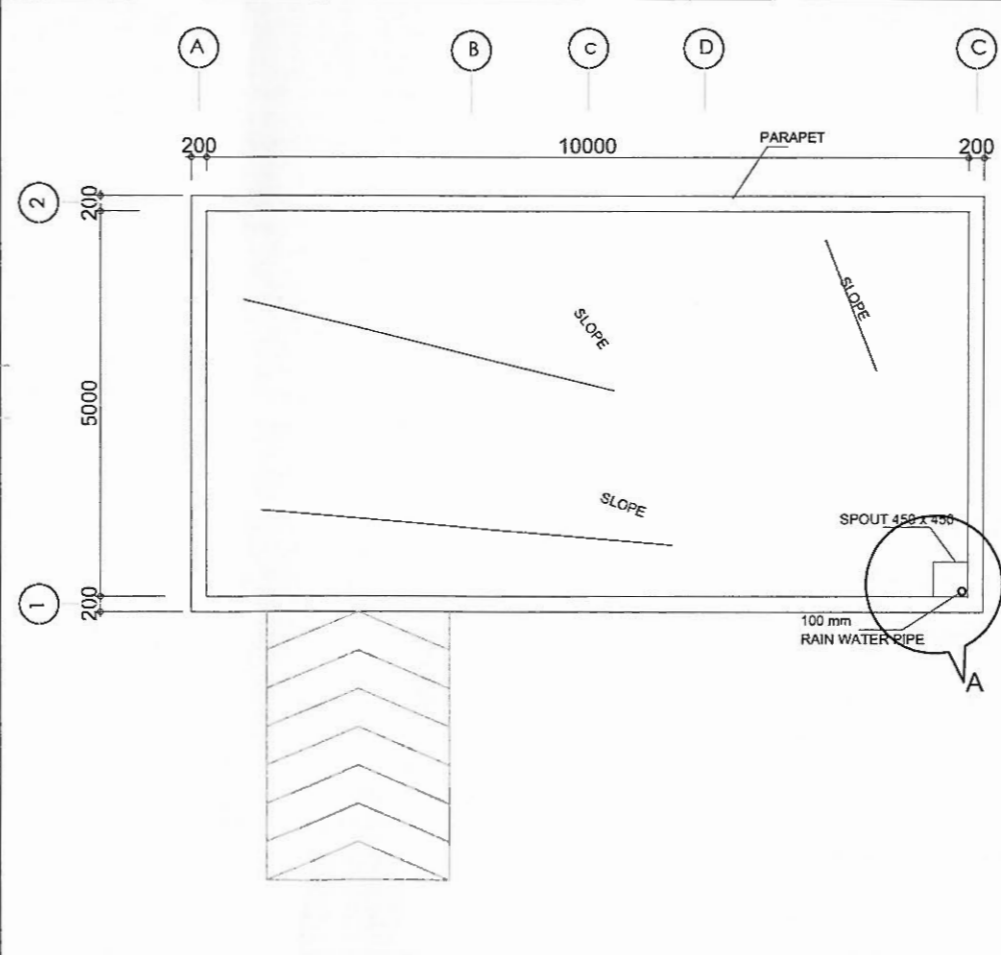
SECTION - BB

SECTION - AA

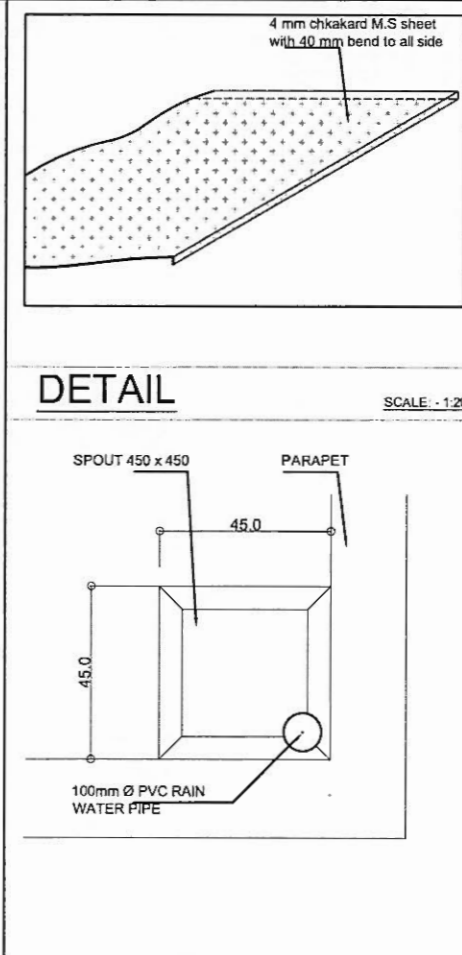
ELEVATION-4



PLAN



ROOF PLAN



DETAIL 'A'

Project:
SPECIAL ECONOMIC ZONE KHAIRPUR

Client:
PROJECT OFFICE
KHAIRPUR SPECIAL ECONOMIC ZONE (KSEZ)
DISTRICT KHAIRPUR

Consultant Architect:

EA Consulting (Pvt.) Limited
Formerly Engineering Associates
Head Office AL-9, 15th Lane, Khayaban-e-Hilal Phase 7, Defence Housing Authority, Karachi 75500 - Pakistan
Phone No. 111-111-5554 Fax No. 554-1525
Email info@ea-world.com | www.ea-world.com

Mark	Date	Description	Sig
01	FEB-16	DOORS & WINDOWS SIZES REV.	

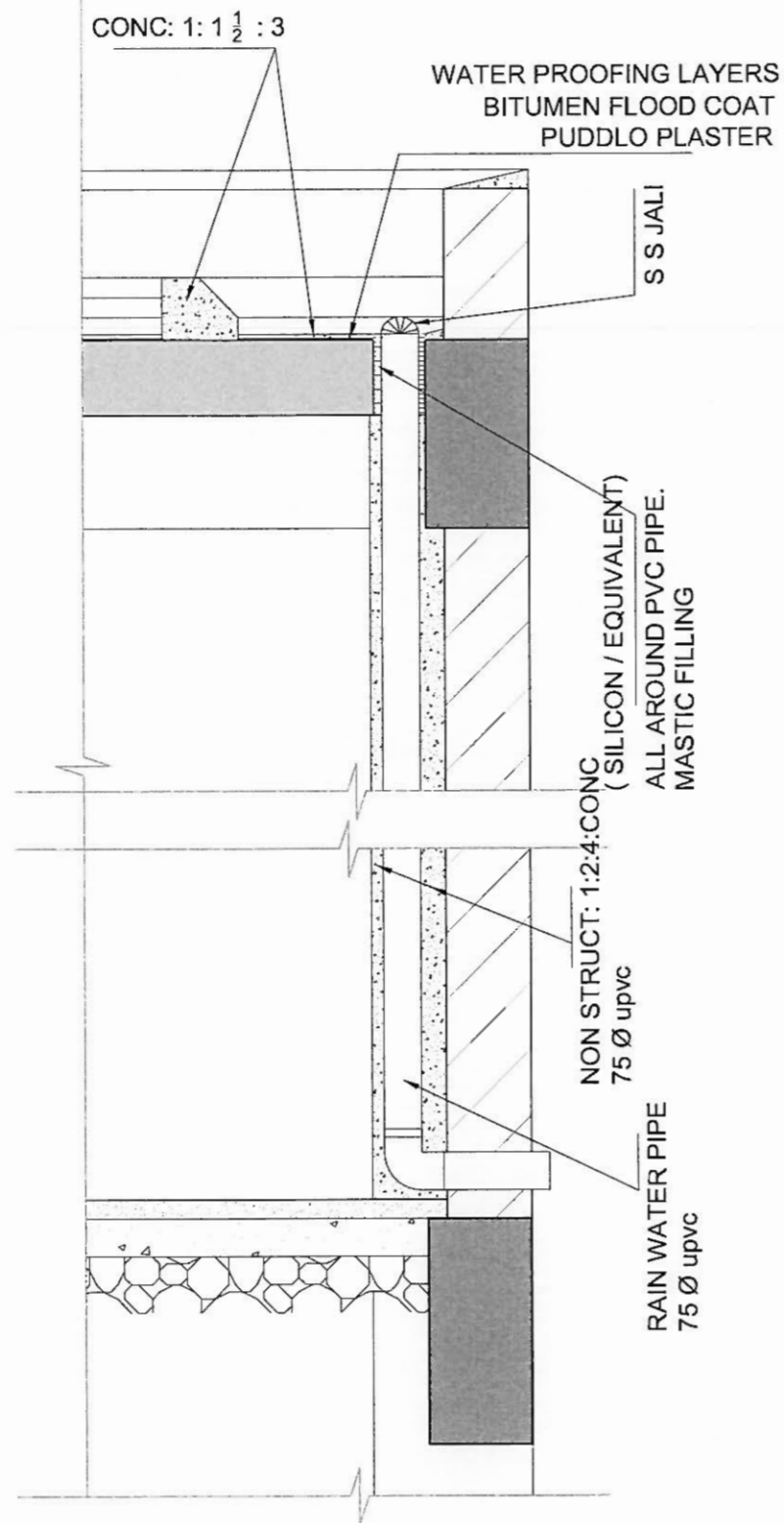
Date of Issue	DECEMBER - 2015
Issued To	CLIENT
Issued For	TENDER

ARCHITECTURAL

Building Name:
MAIN SUBSTATION

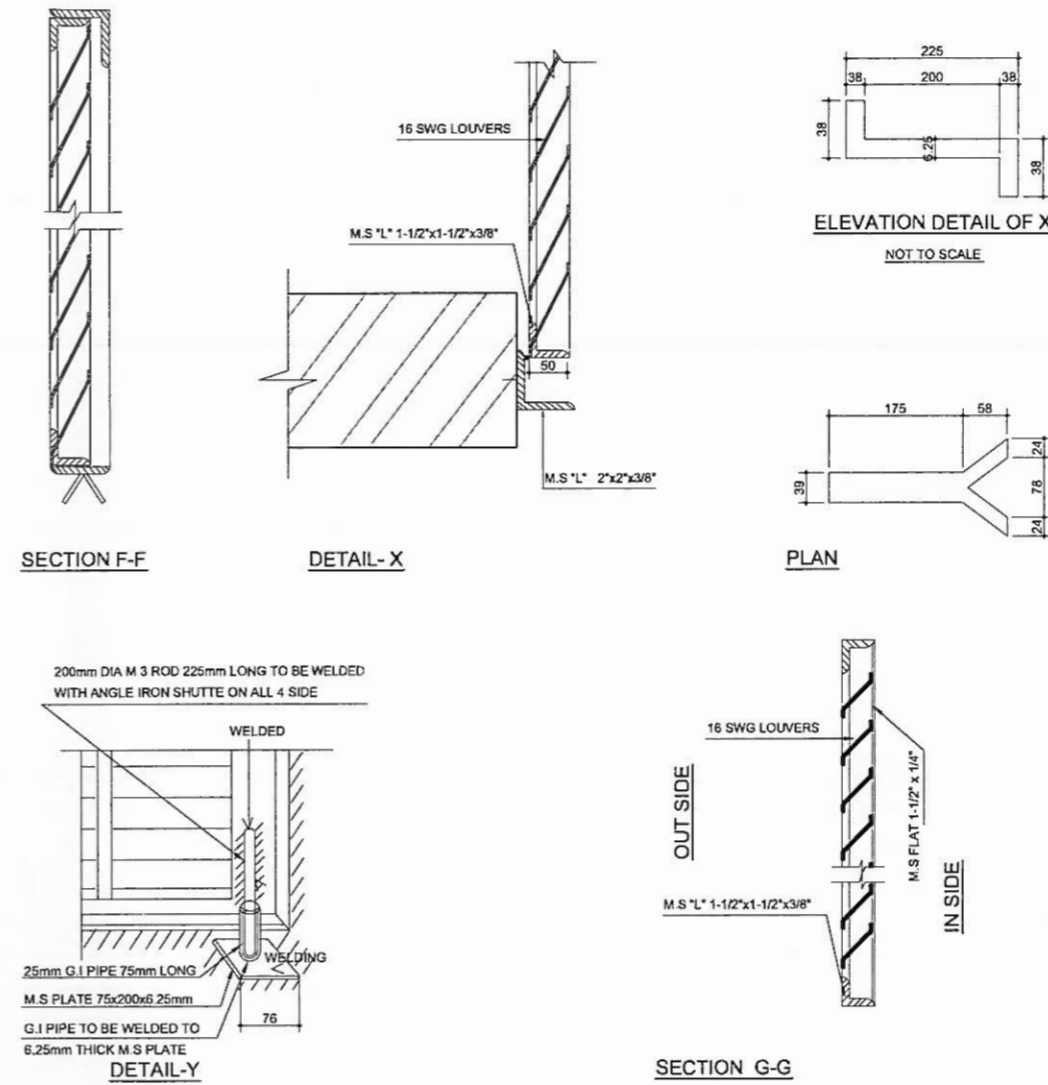
Drawing Title:
PLANS ELEVATIONS & SECTIONS

Designed	S.K.	Checked	N.K.	Approved	N.I.K.
Drawn	F.A.	Date	DEC-2015	Scale / Sheet	1:50 @ A1
Project Code	660	Rev	01	Drawing No.	EA-660-MST-101



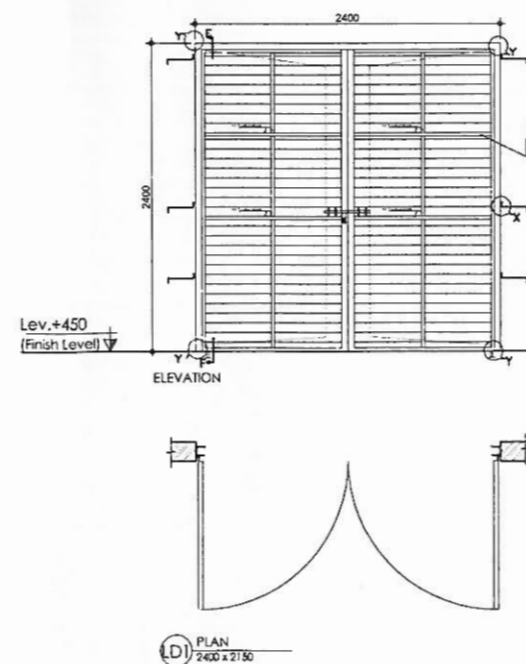
DETAIL SECTION RAIN WATER PIPE

SCALE: 1:10



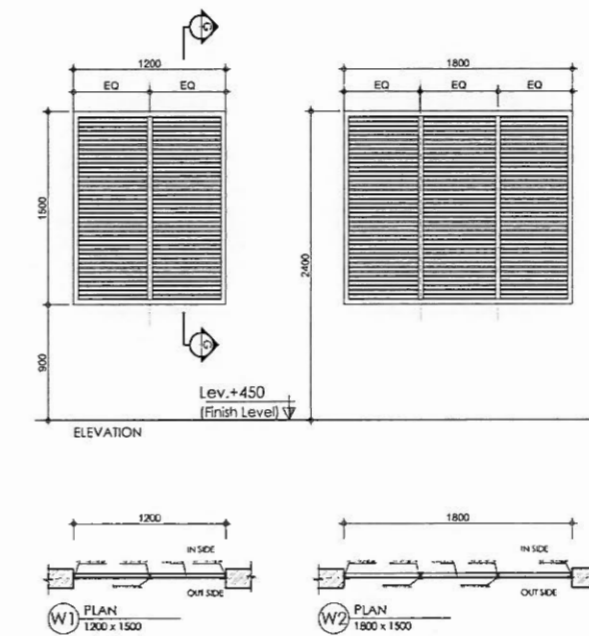
DETAIL OF LOUVERED DOOR / WINDOW

SCALE: 1:5



DETAIL OF LD1

SCALE: 1:30



DETAIL OF W 1 & W2

SCALE: 1:30

Project:
**SPECIAL
ECONOMIC
ZONE
KHAIRPUR**

Client:
PROJECT OFFICE
KHAIRPUR SPECIAL
ECONOMIC ZONE (KSEZ)
DISTRICT KHAIRPUR

Consultant Architect:

EA Consulting (Pvt.) Limited
Formerly Engineering Associates
Head Office AL-9, 15th Lane, Khaybani-e-Hilal Phase 7
Defence Housing Authority, Karachi 75500 - Pakistan
Phone No 111-111-584 Fax No 504-1025
Email info@ea-world.com | www.ea-world.com

Sl	Date	Description	Rev
01	FEB.16	DOORS & WINDOWS SIZES REV	

Date of Issue	DECEMBER - 2015
Issued To	CLIENT
Issued For	TENDER

ARCHITECTURAL

Building Name:
MAIN SUBSTATION

Drawing Title:
DETAILS

Designed	Checked	Approved
RIAZ	N.K.	N.I.K.
Drawn	Date	Scale / Sheet
F.A.	DEC.2015	AS SHOWN
Project Code	Rev	
	660	01
Drawing No	EA-660-MST-102	

**PROJECT OFFICE
KHAIRPUR SPECIAL ECONOMIC ZONE
DISTRICT KHAIRPUR**

MAIN SUBSTATION

**TENDER DRAWINGS
(ELECTRICAL)**

FEBRUARY. - 2016



EA Consulting Pvt Ltd

AL - 9, 15th Lane, off Khayaban - e - Hilal, Phase 7,
Defence Housing Authority, Karachi. , 75500-Pakistan
Phone No.+92 21 5841821-4. Fax No.+92 21 5841825
Email : info@eaworld.com | www.eaworld.com

Project
SPECIAL
ECONOMIC
ZONE
KHAIRPUR

Client
CITY DISTRICT
GOVERNMENT
KHAIRPUR

Consultant Architect:

EA Consulting (Pvt.) Limited
Formerly Engineering Associates
Head Office AL-9, 15th Lane, Khayaban-e-Hisr Phase 7
Defence Housing Authority Karachi - 75600 - Pakistan
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Email info@ea-world.com | www.ea-world.com

S.#	DRAWING NO.	DRAWING TITLE
01	EA-660-E-00	LIST OF DRAWINGS
02	EA-660-E-01	LEGEND, & EARTHING INSTALLTION DETAILS
03	EA-660-E-02	MV SINGLE LINE DIAGRAM DISTRIBUTION SCHEME BETWEEN SUB STATION TO SUB STATION
04	EA-660-E-03	MV PANEL ARRANGEMENT ,TRENCH DETAIL,LIGHTING & POWER PLAN
05	EA-660-E-04	MV CABLE ROUTING LAYOUT FROM MAIN SUB STATION TO SUB STATION NO1,2,3,4
06	EA-660-E-05	LV CABLE ROUTING LAYOUT FROM TRAFO -2 TO MAIN SUB STATION

Mark	Date	Description	Sig

REVISIONS

Date of Issue	DECEMBER - 2015
Issued To	CLIENT
Issued For	TENDER

ELECTRICAL

TENDER

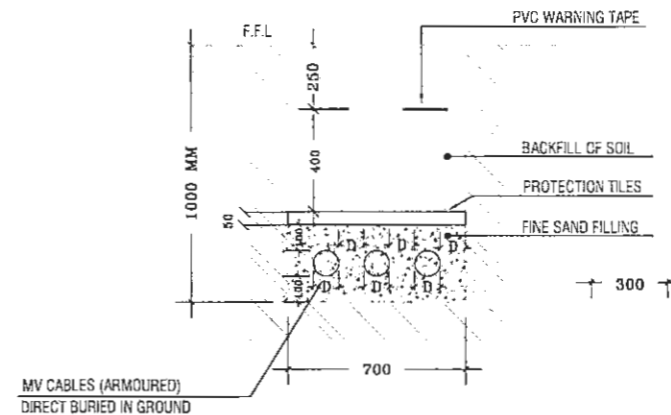
Building Name
MAIN SUB STATION

Drawing Title
LIST OF DRAWINGS

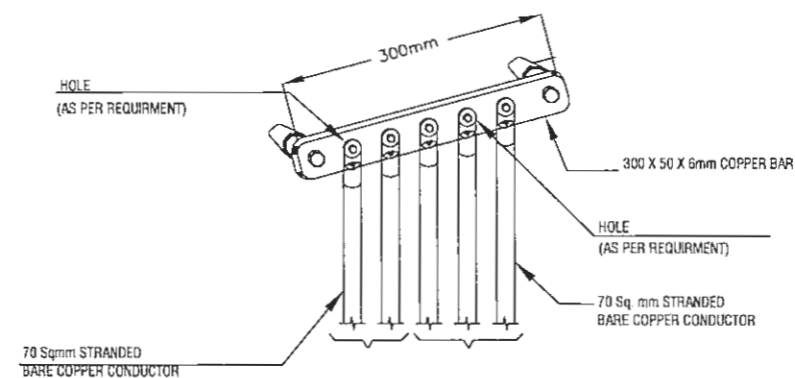
Designed	Checked	Approved
F I	F I	J I S
Drawn	Date	Scale / Sheet
M W	DEC 2015	1:50 @ A1
Project Code	Rev	
660	00	
Drawing No	EA-660-E-00	

S.No.	NORMAL SYMBOL	DESCRIPTION	LAMP	MOUNTING
1		FLUORESCENT LIGHT FIXTURE (PHILIPS TMS OR EQUIVALENT)	2 x 28W T5 COLOR 84	SURFACE / WALL
2		BULK HEAD OUTDOOR LIGHT FIXTURE (IP65)	1 x 11W CFL LAMP	SURFACE / WALL
3		LIGHTING SWITCH (N GANG)		1200mm-FFL
4		15A SWITCH SOCKET OUTLET		450mm-FFL
5		DISTRIBUTION BOARD		1200mm-FFL
6		INDICATION LAMPS		
7		EXHAUST FAN		
8		SP MCB		
9		TP MCCB		
10		EARTH CONNECTING POINT		
11		EARTH PIT WITH PLATE TYPE EARTH ELECTRODE		
12		EARTH PIT WITH ROD TYPE EARTH ELECTRODE		

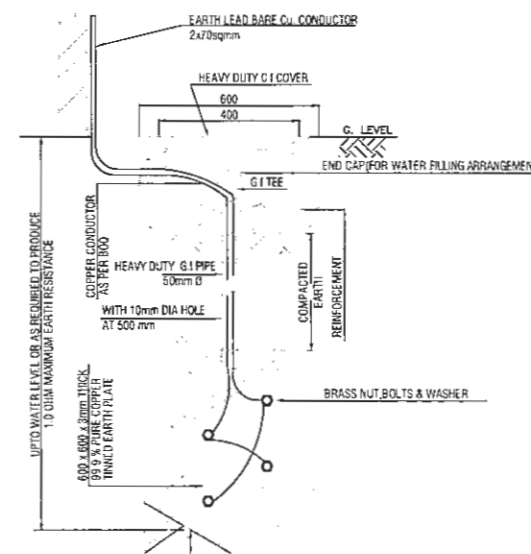
LEGEND



MV CABLE UNDER GROUND INSTALLATION DETAIL



EARTH CONNECTING POINT



EARTHING CU PLATE DETAIL

Project
SPECIAL ECONOMIC ZONE KHAIRPUR

Client
CITY DISTRICT GOVERNMENT KHAIRPUR

Consultant Architect:

EA Consulting (Pvt.) Limited
Formerly Engineering Associates
Head Office AL-9, 15th Lane, Khayaban-e-Hafal Phase 7, Defence Housing Authority, Karachi 75500 - Pakistan
Phone No. 111-113584 Fax No. 551-1825
Email info@ea-world.com | www.ea-world.com

Mark	Date	Description	Sign
01	FEB 2016	ISSUED FOR TENDER	J.I.S

Date of Issue	DECEMBER - 2015
Issued To	CLIENT
Issued For	TENDER

ELECTRICAL

TENDER

Building Name
MAIN SUB STATION

Drawing Title
LEGEND & EARTHING INSTALLATION DETAILS

Designed	Checked	Approved
F.I	F.I	J.I.S
Drawn	Date	Scale / Sheet
M.W	DEC 2015	N.T.S @ A1
Project Code	Rev	
	660	00
Drawing No	EA-660-E-01	

SPECIAL
ECONOMIC
ZONE
KHAIRPUR

Client:

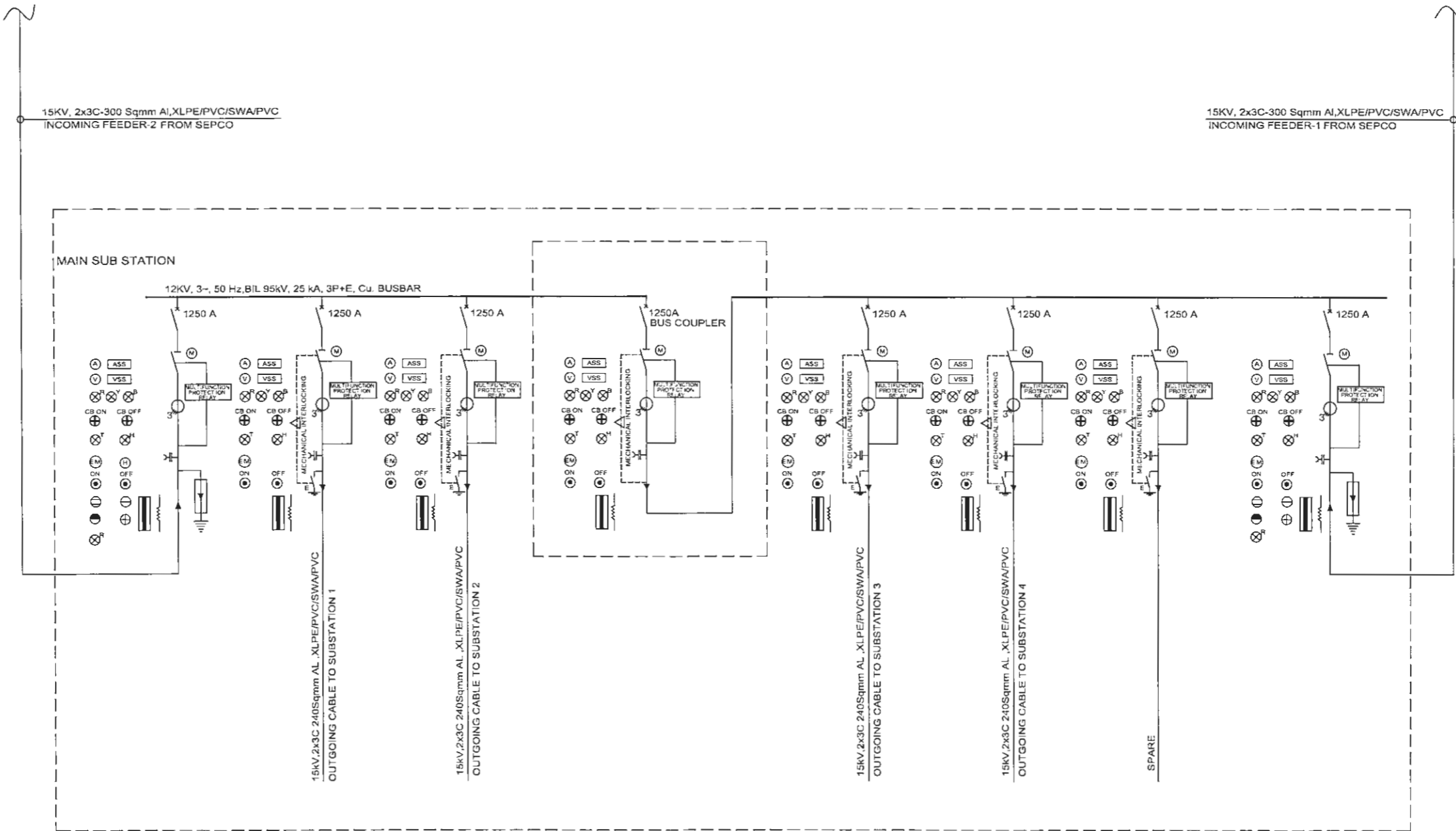
CITY DISTRICT
GOVERNMENT
KHAIRPUR

Consultant Architect:

EA Consulting (Pvt.) Limited
Formerly Engineering Associates
Head Office AL-8, 13th Lane, Khyabara-Hal Phase 7,
Defence Housing Authority Karachi 7500 - Pakistan
Phone No. 111-111-564, Fax No. 564-1625
Email info@ea-world.com | www.ea-world.com

LEGEND

SYMBOLS	DESCRIPTION
	12KV VACUUM CIRCUIT BREAKER (VCB), BIL 95KV, 25KA FOR 3 SEC
	SURGE ARRESTER
	EARTHING SWITCH
	3Nos. CURRENT TRANSFORMERS WITH SHORT LINKS (2-CORE) 600-400/5/5A
	3Nos. POTENTIAL TRANSFORMER (11000/√3/110/√3 V)
	VOLT METER (0-15kV)
	VOLT METER SELECTOR SWITCH (4 POSITION)
	AMPERE METER
	AMPERE METER SELECTOR SWITCH (4 POSITION)
	ENERGY METER (KWH / KVARH) WITH MDI, P, F ETC.
	PUSH BUTTONS ON AND OFF ELECTRICAL CIRCUIT BREAKER
	INDICATION LAMP FOR PHASES R-RED, Y-YELLOW, B-BLUE
	INDICATION LAMP FOR VCB ON AND OFF
	CIRCUIT BREAKER TRIP INDICATION LAMP T-AMBER
	HEATER 'ON' INDICATION LAMP (BLUE)
	HOOTER
	O/C, S/C, E/F RELAY WITH TEST BLOCK
	PUSH BUTTON ALARM ACKNOWLEDGEMENT
	PUSH BUTTON LOCK OUT / RESET
	PUSH BUTTON HOOTER MUTE
	ANTI CONDENSATION HEATER WITH THERMOSTAT
	MOTORIZED (VCB)
	PANEL LIGHT WITH LIMIT SWITCH
	PUSH BUTTON LAMP TEST
	FAULT INDICATION LAMP (RED)



Rev	Date	Description	Sig
00	FEB 2016	ISSUED FOR TENDER	J.I.R.

Date of Issue	DECEMBER - 2015
Issued To	CLIENT
Issued For	TENDER

ELECTRICAL

Status: TENDER

Building Name: MAIN SUB STATION

Drawing Title: MV SINGLE LINE DIAGRAM DISTRIBUTION SCHEME BETWEEN SUB STATION TO SUB STATION

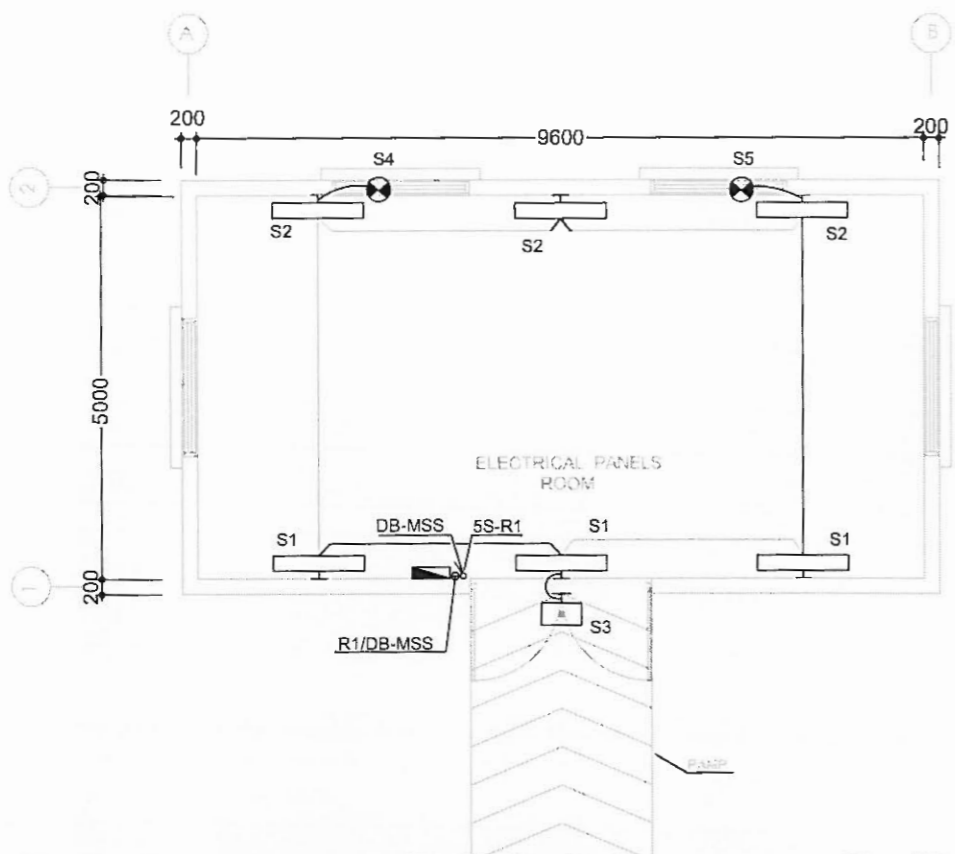
Designed	Checked	Approved
F.I.	F.I.	J.I.S.
Drawn	Date	Scale / Sheet
M.W.	DEC 2015	N.T.S.
Project Code	660	Rev 00
Drawing No	EA-660-E-02	

Project:
SPECIAL ECONOMIC ZONE KHAIRPUR

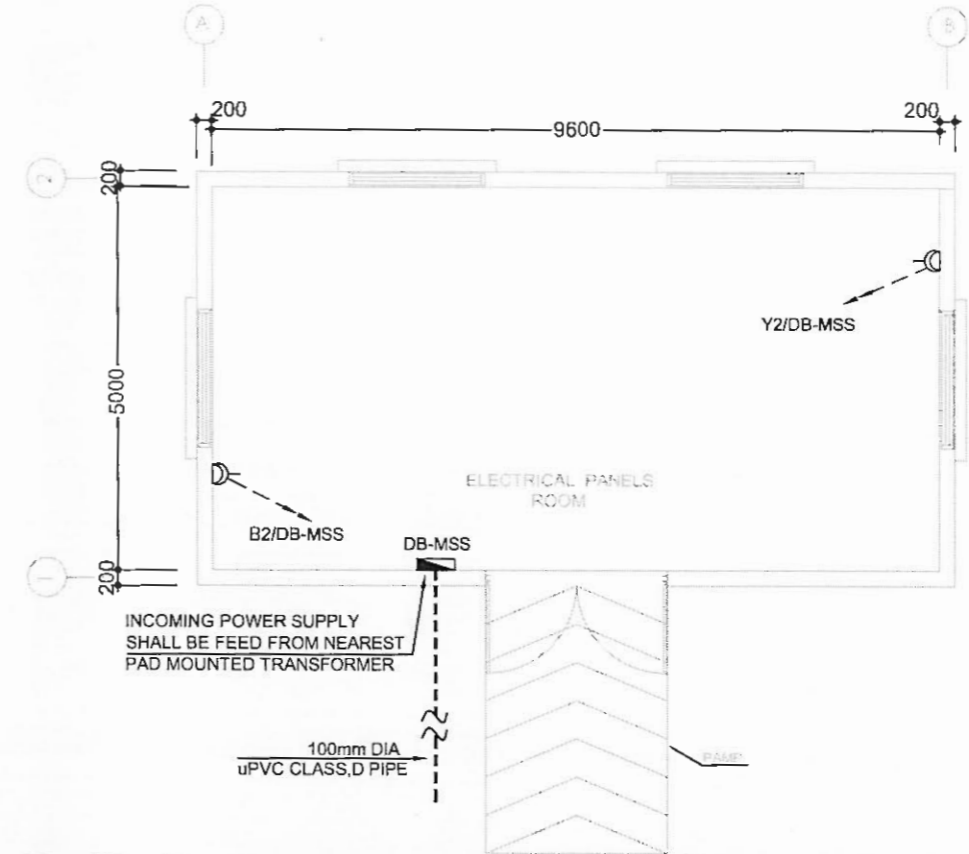
Client:
CITY DISTRICT GOVERNMENT KHAIRPUR

Consultant: Architect

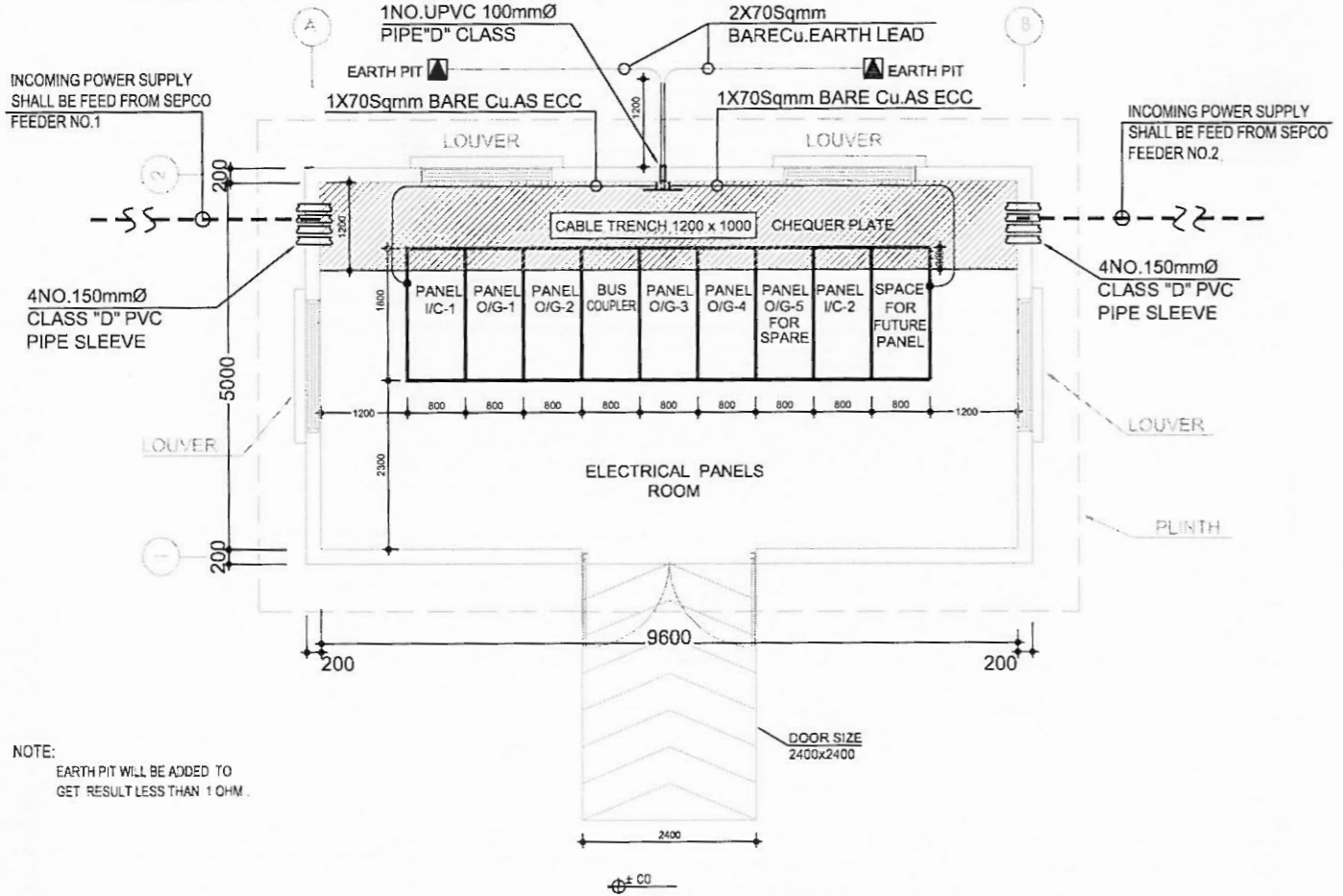
EA Consulting (Pvt.) Limited
 Formerly Engineering Associates
 Head Office AL-9, 15th Lane, Khayaban-e-Hisak Phase 7, Defence Housing Authority, Karachi 75500 - Pakistan
 Phone No: 111-111-554, Fax No: 564-1825
 Email: info@eaworld.com | www.eaworld.com



LIGHTING PLAN

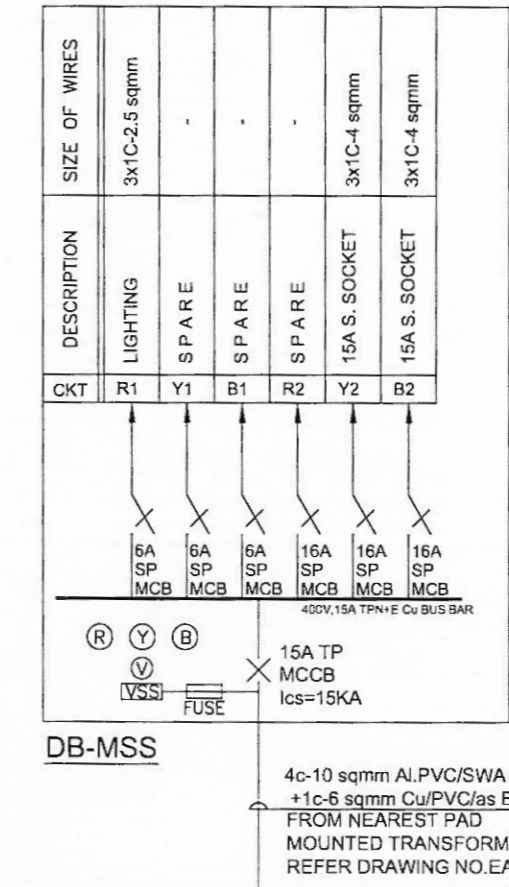


SMALL POWER PLAN



ELECTRICAL PANEL ARRANGEMENT AND TRENCH DETAIL

NOTE:
EARTH PIT WILL BE ADDED TO GET RESULT LESS THAN 1 OHM.



SINGEL LINE DIAGRAM DB MAIN SUBSTATION

Mark	Date	Description	Sig
01	FEB 2016	ISSUED FOR TENDER	JIS

Date of Issue	DECEMBER - 2015
Issued To	CLIENT
Issued For	TENDER

ELECTRICAL

TENDER

Building Name:
MAIN SUB STATION

Drawing Title:
MV PANEL ARRANGEMENT, TRENCH DETAIL, LIGHTING & POWER PLAN

Designed	Checked	Approved
F.I	F.I	J.I.S
Drawn	Date	Scale / Sheet
M.W	DEC 2015	1:50 @ A1
Project Code	660	Rev: 00
Drawing No:	EA-660-E-03	

Project:
SPECIAL ECONOMIC ZONE
KHAIRPUR

Client:
CITY DISTRICT GOVERNMENT
KHAIRPUR

Consultant Architect:

EA Consulting (Pvt.) Limited
 Formerly Engineering Associates
 Head Office: AL-9, 15th Lane, Khayaban-e-Hilal Phase 7, Defence Housing Authority, Karachi, 75500 - Pakistan
 Phone No: 111-111-584, Fax No: 564-1825
 Email: info@eaworld.com | www.eaworld.com

LEGEND

SYMBOLS	DESCRIPTION
	S/S SUBSTATION
	(15KV, 1X3C, 240 SQMM ALXLPE/PVC/SWA/PVC) (EXISTING POWER SERVICE COVERED IN PREVIOUS TENDER PACKAGE DRAWING)
	UPVC PIPE / SLEEVES 4 INCH (100mm) & 4 INCH (100mm) UPVC PIPES IN 2 ROWS COVERED IN PREVIOUS TENDER PACKAGE DRAWING
	UPVC PIPE / SLEEVES 4 INCH (100mm) UPVC PIPES IN 2 ROWS COVERED IN PREVIOUS TENDER PACKAGE DRAWING

Mark	Date	Description	Sig.
00	FEB.2016	ISSUED FOR TENDER	J.I.S

REVISIONS

Date of Issue	DECEMBER - 2015
Issued To	CLIENT
Issued For	TENDER

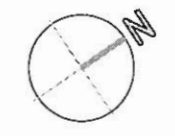
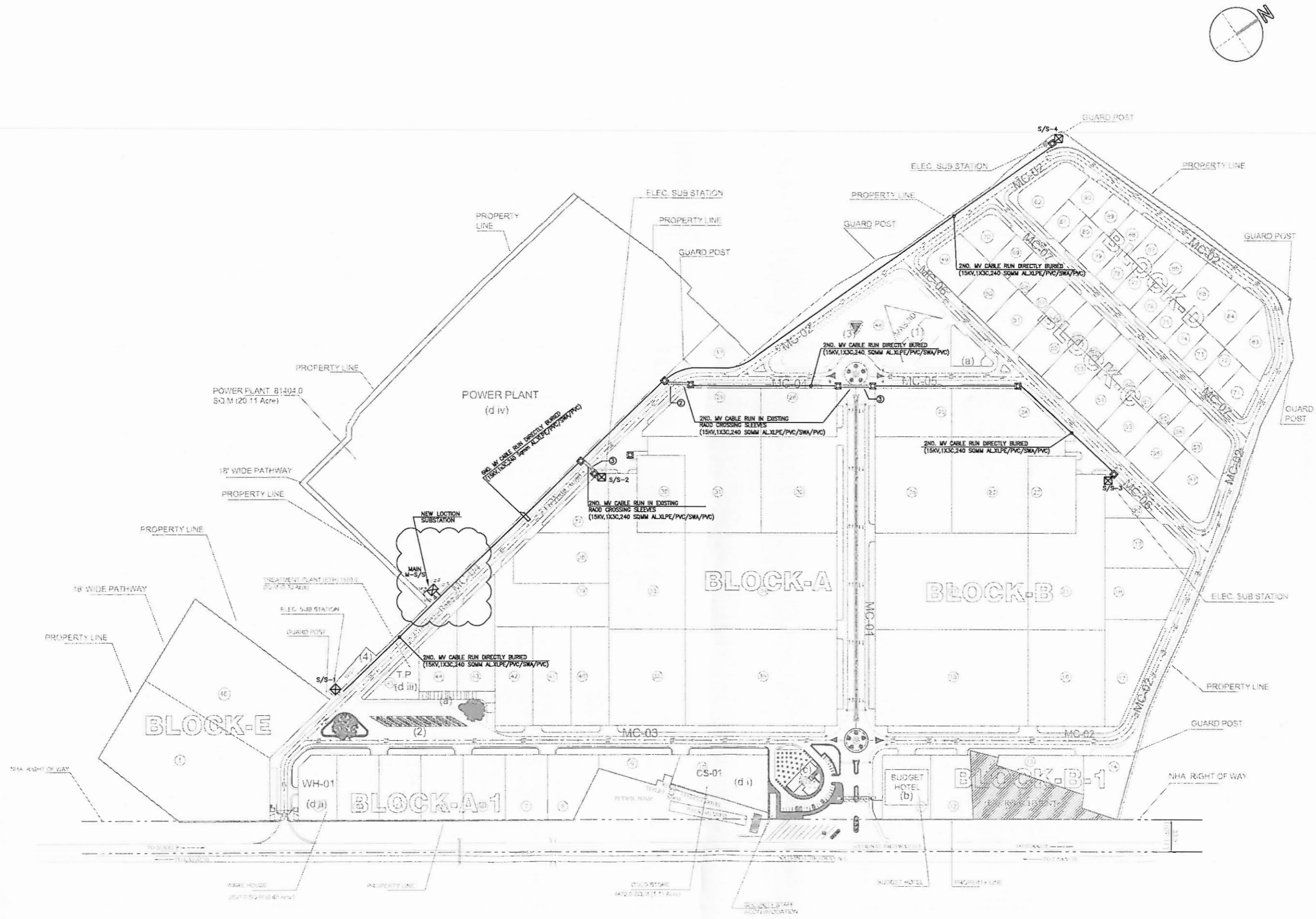
ELECTRICAL
TENDER

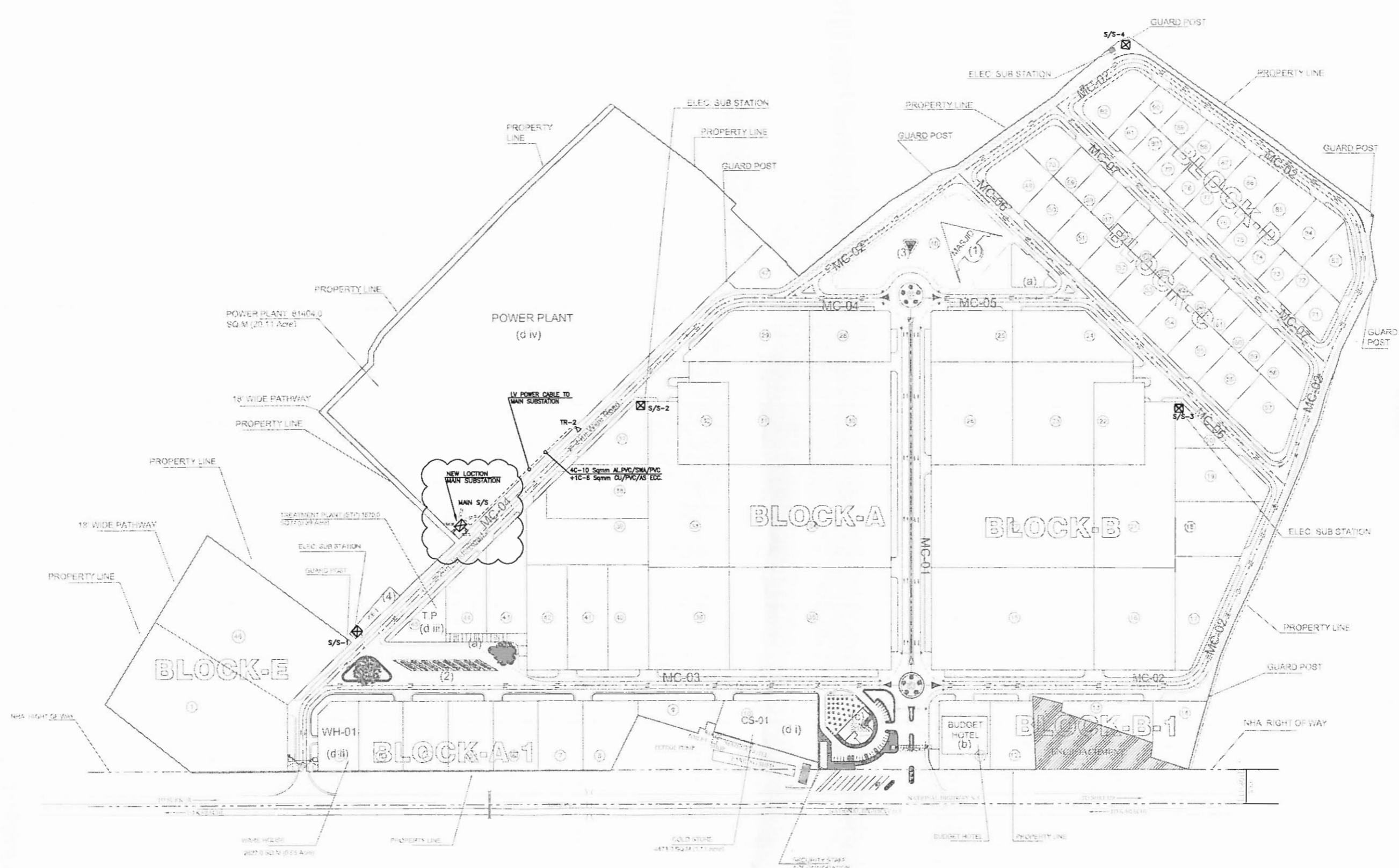
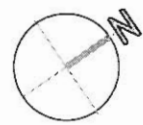
Building Name:
MAIN SUB STATION

Drawing Title:
MV CABLE ROUTING LAYOUT FROM MAIN SUB STATION TO SUB STATION NO.1,2,3,4

Designed:	Checked:	Approved:
F.I	F.I	J.I.S
Drawn:	Date:	Scale / Sheet:
M.W	DEC 2015	1:2000 @ A1
Project Code:	Rev:	
660	00	

Drawing No.: **EA-660-E-04**





Project:
SPECIAL ECONOMIC ZONE KHAIRPUR

Client:
CITY DISTRICT GOVERNMENT KHAIRPUR

Consultant Architect:

EA Consulting (Pvt.) Limited
 Formerly Engineering Associates
 Head Office AL-9, 15th Lane, Khayaban-e-Hilal Phase 7, Defence Housing Authority, Karachi 75500 - Pakistan
 Phone No. 111-111-584, Fax No. 564-1825
 Email: info@eaworld.com | www.eaworld.com

LEGEND

SYMBOLS	DESCRIPTION
☒	SUBSTATION
▽	ASB HAS NO MOUNTED TRANSFORMER COVERED IN PREVIOUS PACKAGE TENDER DRAWING.
----	LV CABLE

Mark	Date	Description	Sig.
00	FEB.2016	ISSUED FOR TENDER	J.I.S

REVISIONS

Date of Issue	DECEMBER - 2015
Issued To	CLIENT
Issued For	TENDER

ELECTRICAL

TENDER

Building Name:
MAIN SUB STATION

Drawing Title:
LV CABLE ROUTING LAYOUT FROM TRAFO-2 TO MAIN SUB STATION

Designed:	Checked:	Approved:
F.I	F.I	J.I.S
Drawn:	Date:	Scale / Sheet:
M.W	DEC 2015	1:2000 @ A1
Project Code:	Rev:	
	660	00
Drawing No.:	EA-660-E-05	